CASSELL'S POPULAR GARDENING

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Madame Levet.
Catherine Mermet.
Marie Van Houtte.

ROSES.

Marshal Niel.
Her Majesty.
Star of Waltham.

CASSELL'S

POPULAR GARDENING.

EDITED BY

D. T. FISH,

ASSISTED IN THE PRESENT VOLUME BY

MR. JAMES BRITTEN, F.L.S., *British Museum.*
MR. WILLIAM COLEMAN, *The Gardens, Eastnor Castle, Ledbury.*
MR. RICHARD DEAN, *Ealing, W.*
MR. WILLIAM EARLEY, *Ilford, Essex.*
MR. WILLIAM HUGH GOWER, *Nurseries, Tooting.*
MR. JAMES HUDSON, *The Gardens, Gunnersbury House, Acton, W.*
DR. MAXWELL T. MASTERS, F.R.S.
MR. WILLIAM WILDSMITH, *The Gardens, Heckfield Place, Winchfield, Hants.*

With numerous Illustrations.

VOL. I.

59, 666

CASSELL & COMPANY, LIMITED:

LONDON, PARIS, NEW YORK & MELBOURNE.

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CASSELL'S
POPULAR GARDENING.

INTRODUCTION.

THE design of this work is, briefly, to bring a knowledge of the best gardening practice, and of the principles on which it is based, within easy reach of the people at large. It may be said that there is no lack of works on gardening already; and this is undoubtedly true. Some of these, however, are scarce; others are expensive; and most of them are now more or less superseded by the rapid advance made in the knowledge and practice of gardening within the last few years. Horticulture has, in fact, lately advanced with such leaps and bounds that its literature has hardly kept pace with the improvements made in its practice. It may also be not unfairly said that the majority of works on horticulture have been written for the few rather than for the many. For one interested in gardening ten years ago, however, a hundred or a thousand are interested to-day; and this large public will, it is hoped, cordially welcome an attempt to place the knowledge and practice of the highest authorities within their reach.

The rapid rise and progress of commercial horticulture, the demand for open spaces, the multiplication and improvement of public parks, the enormous imports of foreign fruit and vegetables, the marvellous increase in the home culture of flowers, fruit, and seeds;—all these things point to an unlimited extension of garden pursuits in the near future. When the imperial importance of horticulture as a powerful factor in augmenting the food supplies, promoting the comfort, elevating the character, and improving the sanitary state of the nation, becomes better known and more generally appreciated, few will rest content until they possess a garden of some sort. And few need any longer stand aside from the pursuit of horticulture, as too difficult or too costly for them. Thoroughly understood and properly practised, it is neither one nor the other; while no pursuit yields quicker returns, or richer revenues of pleasure, profit, and relaxation for the money and time invested in it.

While aiming, therefore, to make this work a safe and sufficient guide for the most experienced, it is hoped to avoid a glaring fault of many current treatises on gardening, viz., an assumption of the possession of too much knowledge on the part of their readers. Beginning at the very beginning of our subject, as regards the EARTH, and those plants which clothe it with plenty and adorn it with beauty, it will be our aim to teach, by a series of easy articles or lessons, how the former may be ameliorated and enriched, and the latter multiplied and improved.

The machinery of the PLANT, its outward conformation, internal organisation, and method of working, as well as the circumstances by which it is influenced, will receive proper explanation. In this department the object will be to call attention to those points in vegetable anatomy and physiology which have a direct bearing on the practice of gardening. We shall endeavour to give the cultivator such a general insight into the structure and working of the plant-machine, as shall enable him to regulate his practice intelligently, and independently of mechanical routine. It is also hoped that the information so provided will be of service, by furnishing suggestions for dealing with novel combinations of circumstances, or matters outside the range of former experience; and thus most effectually enable the cultivator to further the progress of his art, and —in some way or the other—leave it better than he found it.

The fullest and latest information will be given on such subjects as the formation and maintenance of ARTIFICIAL CLIMATES, by the erection and warming of GLASS-HOUSES or other structures; the formation and furnishing of the VEGETABLE, FLOWER, and FRUIT GARDENS; and the propagation by every known means of all the plants of the garden. The CULTURE OF FLOWERS and DECORATIVE PLANTS will be treated from various points of view. The general formation of the Flower Garden, with methods of keeping up an attractive display throughout the changing seasons, will be dealt with. The plants themselves will also be described in detail, with their special methods of culture and propagation; the greenhouse and parterre receiving equal attention. ROSES will receive copious treatment in a series of special articles devoted to their propagation, culture, pruning, training, use in garden landscape, selective and descriptive lists of the choicest varieties—old and new—for gardens large and small, the clothing of walls, culture in pots and under glass, and planting in out-of-the-way places. In a word, we hope to teach every reader how to form, furnish, and cultivate his garden in the best way, at the least cost, and to the most profitable and pleasant purpose.

Without wholly endorsing the suggestive saying, that the smaller the garden the greater is the skill needed to manage it aright, we are so keenly alive to the trials and discouragements of small gardeners, that we purpose to specially afford as full and safe guidance and as much encouragement to those whose gardens may be found in the front and back yards, area, or house, as to others who may grow acres of fruit or flowers under glass or in the open. SUBURBAN GARDENING will have a series of articles to itself, as also will WINDOW GARDENING, and other forms of horticulture in or about the home.

Writers of special knowledge and proved ability in every department and phase of gardening have undertaken to treat these various subjects; and wherever illustrations can assist, either to give an adequate idea of flower or plant, to explain the details of pruning, grafting, or other operations, to elucidate a system, or to make clear the structures or appliances described, they will be freely employed. Neither labour nor expense will be spared to make the following pages a full and safe guide for gardens of all sizes, and for all sorts and conditions of gardeners.

GARDEN-POTS AND POTTING.

GARDEN-POTS.

IT is impossible to over-estimate the vital importance of these appliances and operations in the prosecution and progress of horticulture. Supposing the supply of garden-pots and the ability to use them withdrawn! horticulture would not merely stand still, but speedily relapse into a state of chaos and retrogression. From seed to finished produce, pots minister to the wants of plants, and nurture them carefully through all the preliminary stages and processes from start to finish. Pots virtually endow plants with locomotive powers, making them safely portable at all times and seasons, and in all places; thus enabling cultivators to concentrate the gems of the vegetable kingdom into any given area. By their exclusive and retentive forces, they also provide specially suitable food for any number of plants, and furnish a separate larder for each when necessary. Pots of proper quality, skilfully used, hold their food-stores almost as securely and safely for the roots, as iron safes with Chubb-locks hold the property of their owners.

But it is not needful to dwell on the usefulness of pots: they are vital necessities to the pursuit of modern horticulture. The demand for them has become so urgent and extensive as to have created and sustained a virtually new trade of enormous dimensions—that of the special manufacture of garden-pots.

The Garden-pot Trade.—Doubtless for many years, in the majority of general potteries, garden-pots have been made. Many of these, from the very circumstances of the case, were more or less inferior. No special preparation of clay or earth was considered necessary, and, as the quantities turned out were limited, few or no special hands were kept for that purpose.

All this is completely changed now. One firm alone—certainly one of the largest in the trade—to whose courtesy we are indebted for some of the facts of this chapter, turns out garden-pots at the rate of a million and a quarter or a million and a half a year. Probably other makers almost equal this enormous average, while there are hundreds of provincial potteries spread broadcast over the country where garden-pots are made and distributed; so that thirty millions a year would probably be a low estimate of the actual number produced. Few facts could give a more vivid picture of the enormous extent and growing power of modern horticulture than the reading of such figures; or better still, were that possible, a bird's-eye view of those piled-up mountains of millions of garden-pots. Mere figures give poor and meagre notions of facts. For example, the number of gallons of bitter beer or stout consumed can hardly be estimated by figures. But enter the stores of full, and the yards of piled-up empty casks, and the magnitude of the consumption grows more and more manifest. Fortunately for most of the makers of the finer qualities of garden-pots, their reserve stores are seldom very large. The demands in the form of orders are so urgent and constant, as almost to outrun supplies. Hardly have the pots been drawn from the kilns before they are whipped off by road, rail, or river to all parts of the three kingdoms; and the potters are such adepts in the art of packing, that as a rule not more breakages will be found after a journey of three hundred miles than take place in one of three.

The pots are not only distributed throughout Great Britain and Ireland, but to other parts of Europe, to Africa, and New Zealand. Consignments of fifty thousand pots at one time are not unknown to the trade, and some of the great nurserymen use from a hundred and fifty thousand to a quarter of a million pots a year. Orders from a hundred thousand down to forty thousand are comparatively common, and, of course, from these large numbers downwards, orders become thick as blackberries. Hence the gross output of garden-pots a year cannot well be less than that which has been stated. To the question, Where do they all go? no very satisfactory answer can be given. Of course, growers for sale, who after all are by far the largest consumers of pots, sell their pots with the plants, and as trade grows, and plants increase, the demand for pots increases with it. Hence firms that wanted one hundred thousand last year, are likely to need one hundred and twenty thousand next, and so in degree in private gardens; hence the demand for pots is sure to increase and extend. The late agricultural depression, which has lasted through several years, checked to some extent the yearly increase of garden-pots. But it has been reported recently that the trade is rapidly recovering, and is likely to exceed all former dimensions.

Material and Quality.—Were a horticultural Rip Van Winkle to wake now, nothing would astonish him so much as the enormous number of garden-pots, and their improvement in shape, texture, and quality. They are as unlike as anything can well be to the older pots of English manufacture, and the inferior ware often received with plants from the Continent. The more the worse, unfortunately applies to not a few of our manufactured products. But the more the better, is emphatically applicable to our modern garden-pots.

Extended insatiable consumption has not only stimulated production, but improved the methods and products. At one time almost any clay that made fair bricks or serviceable drain-tiles was held to be good enough for garden-pots. Hence not a few of them were coarse, clumsy, heavy, almost as heavy as bricks—very little better, in fact, for cultural purposes, or conveyance to distant parts. Modern garden-pots are light, strong, clean, and durable. Their quality is almost all that can be desired, while prices have fallen rather than risen with their improvement.

Several causes have contributed to this result. Most of the leading potters are men who not only put their capital but their hearts into their business. They have a laudable pride in the quality of their wares. Competition in garden pottery, and the offer of medals, or other prizes, at the Manchester, metropolitan, and other great horticultural shows, for the best garden-pots, has also done a good deal to improve it. A manufactory at Weston-super-Mare has been the fortunate winner of most of the premier prizes at these competitions. Some attribute this to the superior quality of the clay at the above place. No doubt this led to the establishment of the manufacture of garden-pots in that locality, about half a century ago. But as much, or more, depends upon due intermixture, and proper working of the clay, as upon its original quality or character. That, however, is of the best quality for the making of garden or other pots, terra-cotta or other vases, window boxes, baskets, &c.

One hundred parts of the dry clay consist of:—

Silica	57·29
Alumina	13·55
Ferric oxide	4·90
Manganese oxide	0·46
Carbonate of Lime	8·84
Magnesia	2·27
Potash	3·62
Loss in Calcination (chiefly water and Carbonic acid)	10·06
	100·99

A layer of this clay overlies clay of inferior quality and other strata, to a depth of about six feet. Good as it is by nature, the potter immediately sets about its further improvement by art, and the preparatory stages of the process are very similar to those adopted in the formation or further improvement of surface mould. Time, admixture, exposure, are the slow but sure influences that bring the clay into workable form, and mellow it into higher quality. To bring these more actively and powerfully to bear upon it, the clay is dug out and spread over the surface to the depth of a yard or so. In this state it is left fully exposed to every vicissitude of our climate; rain, wind, sun, and frost being the most powerful agents in improving the quality of the mass. After the first layer is sufficiently weathered, a second, third, or more layers may be added until the clay-heap reaches to any convenient height. The longer the clay can be exposed thus, the better as a rule its quality. Before use, this heap of weathered clay is turned over, and thoroughly mixed and incorporated in the process. It is then passed through a mill, which completes the mixing and the tempering of the clay, converting the whole into a plastic mass of as nearly as possible uniform quality. From the pug-mill it is carried to the throwing sheds, where it is worked almost as bread is before being placed in the oven; the workmen being assisted in completely working the clay by cutting it asunder with wires, and dashing it together again, until it becomes sufficiently pliable and homogeneous to be converted into garden-pots.

These particulars refer only to the best clay; when stones abound in the clay, or it contains an excess of silica, the one must be screened and the other washed out before the clay reaches this stage. When the amalgamation of all the parts of the clay is completed, and its homogeneity is perfected, it is then divided into bolls or balls, in a similar way to the division of dough into roll or loaf pieces. These vary in size, according as the pots are to be large or small, and practice enables the workmen to separate the clay into the exact-sized ball needed for any sized pot, with scarcely an atom of loss or excess. Before reaching this stage, however, it was the practice at one time to divide the clay into portions termed casts. These were all of equal size, and thus one cast of clay might make eighty pots or one only, according to the size. Hence eighty, sixty, forty-eight, thirty-two, twenty-four, sixteen, twelve, eight, six, four, two, or one pot, out of a cast or measure of clay, became popular and useful measures of sizes. Until very recently the numbers in the cast were the only index to measure in the ordering of pots. As the amount of clay was the same, the same wages—until the larger sizes were reached—were paid for making eighty pots, twenty-four, or twelve, and the same price was charged to the purchaser. This system of selling pots is now generally abolished, and a sliding scale of prices is established, ranging from a farthing to five-and-twenty shillings or more per pot, and from threepence to eighteen shillings per dozen. But from the grinding, moulding, or throwing sheds, where the clay has been worked into quality, and divided into balls, it is cast to the thrower, who sits at his wheel, and moulds the finished pots out of the balls as if by magic, by the aid of his fingers. This

is one of the most primitive and astonishing of all the processes in the art of pot-making. The potter's wheel has undergone little or no improvement since the Israelites made pots, doubtless as well as bricks, on such hard lines in Egypt; and any one that looks at the speed and perfection with which, under the spell of the eye and hand of the potter, it does its work, cannot wonder that in a world of change this rude piece of mechanism remains the same throughout the ages. As the pots are made, they are ranged by fifties, more or less according to size, on a drying-board, and placed in drying-sheds until fit for baking. When they arrive at this state, they are made into nests, as it is technically called—that is, the different sizes are slipped into one another until the whole is filled with pots, and so placed in the oven. This economises space to the utmost, and has also other advantages. When the kiln is filled, the door is built up, and rendered air-tight with clay. The fires are then lighted, and a strong heat kept up for two or three days of twenty-four hours each. The fire is then allowed to die out, and the fire-place is hermetically sealed to allow the glowing mass of pots to cool slowly and regularly, sudden changes of temperature having a tendency to fracture the pots at this stage. When cool the pots are withdrawn. In large establishments, where from fifty to sixty men and boys are employed, several kilns are in use; as they can hardly be filled with pots, the pots be drawn, and filled again, within less than a week.

As the making of garden-pots in quantity is a very modern manufacture, and information in relation to it is rare, and not readily accessible, it is hoped the details here given will prove useful and interesting to our readers.

Cleanliness.—This merit was named in connection with the other good qualities of strength, lightness, and durability. The phrase, however, is liable to be misunderstood. All new garden-pots are clean, but what of the old ones? Ah! there's the rub. Now the best garden-pots, such as those here described, will *wear* clean; that is, the texture and quality is such that they offer no foothold for fungoid growths on their outer surface, nor adherence of earth to their inner sides. The best pots are more or less porous; less, however, rather than more. This matter will be further adverted to in estimating the merits or demerits of glazed pots. Pots sufficiently porous to be seldom or never dry are decidedly dirty pots; the damp invites and retains all sorts of atmospheric impurities, and living spores cling to, abide, and grow on their slimy surfaces. Similar processes go on inside; and pots thus coated without and within with foreign excrescences and impurities are totally unable to maintain the plants imprisoned or poisoned in or through them in health and vigour. A good pot, when dry, rings clear as a bell; a bad one gives forth a dull sound, more like a soaked brick or a log of wood. No amateur should purchase old pots. They are not seldom poisoned with dirt, and infested with the germs of the most troublesome vermin, and are far too dear even if got for nothing. Purchase only of the best makers, as these cannot afford to make or sell bad pots. They either give them away should any occur by accident, or smash them at the kiln's mouth. The maker who makes and sells fifteen or twenty thousand pots a week, cannot afford to make them of inferior quality: it is the quality alone that creates and sustains the trade, and consequently that must be upheld at any sacrifice or cost.

Sizes and Shapes.—If what has been said about casts has been clearly understood, it will be seen that pots must be of many varied sizes, when the same clay that may be moulded into one will make eighty, or even a hundred. These extreme variations of size are also necessary, as the seedling almost too small to handle finds a suitable home in a thimble-pot, while the orange-tree, camellia, oleander, or fuchsia, ten feet high and five through, is as much at home in a number four, two, or one-sized pot. The old names and sizes of pots were as follows; and as they are still used in some parts of the country it may be useful to give them here, as well as the newer nomenclature, which is based on measurement only:—

OLD NAMES AND SIZES.

Depth.	Diameter.	Number to Cast.	Name.	
Inches.	Inches.			Inches.
18	20	1	Ones or	20
14	18	2	Twos ,,	18
13	15	4	Fours ,,	15
12	13	6	Sixes ,,	13
11	12	8	Eights ,,	12
10	11½	12	Twelves ,,	11
9	9½	16	Sixteens ,,	9
8	8½	24	Twenty-fours ,,	8
6	6	32	Thirty-twos ,,	6
5	4½	48	Forty-eights ,,	5
3½	3	60	Sixties ,,	3
2½	2½	80	Eighties or Hundreds ,,	2½

The modern current list of sizes is as follows. It gives the diameter only; and these are inside measurements about an eighth of an inch below the rim. These sizes and prices may be said to be the average of the trade generally, not only of one eminent manufacturer; and it may therefore prove

useful to give them entire, with their ordinary prices:—

MODERN NAMES AND SIZES.

	Clear Inside Diameter.	Price per doz.		Clear Inside Diameter.	Price per doz.
No.	Inches.	£ s. d.	No.	Inches.	£ s. d.
1	1¾	0 0 3	13	11	0 7 0
2	2¼	0 0 3	14	12½	0 10 6
3	2¾	0 0 4	15	14	0 14 0
4	3½	0 0 5	16	15	0 17 6
5	4	0 0 6	17	16	1 1 0
6	4¾	0 0 9			EACH.
7	5½	0 1 0	18	18	0 2 6
8	6¼	0 1 6	19	20	0 4 6
9	7	0 2 0	20	22	0 9 0
10	8	0 2 6	21	24	0 12 6
11	9	0 3 6	23	26	0 17 6
12	10	0 4 6	24	30	1 5 0

As the railway freight on heavy goods so often proves a formidable item in their cost, the following table of weight per 1,000, 500, 100, 12, and 6 pots respectively from No. 1 to No. 24, is given, and also the number of each required to make a ton. All that is needful in ordering pots from a distance is, simply to compare the number wanted with the table, note the weight, and ascertain the freight per hundredweight or ton between the pottery and the nearest station, and add this to the net cost of the pots at the pottery, and so find the whole cost, and prevent any miscalculation:—

TABLE OF WEIGHTS.

No.	Number of Pots.	Weight, about	Number of Pots to One Ton, about
		Tons. Cwts. Qrs.	
1	1,000	0 1 1	16,000
2	1,000	0 1 3	12,000
3	1,000	0 3 0	6,500
4	1,000	0 4 0	5,000
5	1,000	0 6 3	3,000
6	1,000	0 10 0	2,000
7	1,000	0 17 0	1,200
8	1,000	1 0 0	1,000
9	500	0 17 0	600
10	500	1 4 0	400
11	500	1 13 0	300
12	500	2 5 0	225
13	100	0 12 0	170
14	100	1 0 0	100
15	100	1 10 0	66
16	100	1 12 0	62
17	100	2 0 0	50
18	12	0 5 2	46
19	12	0 7 2	34
20	12	0 10 0	24
21	6	0 6 0	20
23	6	0 7 0	17
24	6	0 9 0	13

It will be observed that from the one inch and three-quarters up to sixteen inches the sizes hardly advance an inch at a time. Such close-fitting sizes are practically useless as far as the shifting of plants from one to the other is concerned; and in this respect the old sizes seem more sensible than the new, inasmuch as there is a greater difference between them. Beyond sixteen inches in diameter there is a difference of two inches between each of the sizes, and this is increased to four inches in the final rise from twenty-six to thirty inches; the latter being an enormous pot very seldom used.

However, the nurserymen and florists have been accustomed to these sizes, as have also the potters, and both classes are almost as conservative in such matters as the thrower's wheel, which persists in going against the sun, and in turning off pots as it did, probably, four or five thousand years ago. Those who want greater difference in size can easily obtain it by leaping over one or more intermediate sizes, and ordering Nos. 1, 3, 5, 7, 9, 11, and so on.

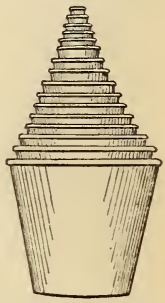


Fig. 1.—Nest of Pots, from 18 in. to 1¾ in.

An illustration of a nest of pots, arranged according to the above list, is given to make the sizes and forms of the common garden-pots more familiar to the general reader (Fig. 1).

Long Toms.—The peculiar characteristic of this form, which has hitherto been chiefly confined to the smaller sizes, included between thumbs and five-inch or less, is that they are deeper than the ordinary make in proportion to their diameter, and that they have no rims (Fig. 2). Being, however, made of the very best clay, and with more than ordinary care, the pots, though also thinner than most others in their sides, are found to be stronger than the average make, though these are fortified with rims. How far it may be possible and safe in practice to abolish rims in the larger sizes, remains to be proved, and will doubtless be put to the test. The chief object gained by the abolition of rims is to economise space in the growth, storing, and packing of small plants. This difference in favour of rimless pots must be seen to be fully appreciated. With the smaller sizes the number of plants placed in the same area may be almost doubled by the abolition of the rims. This is of enormous importance when and where thousands and tens of thousands of these are raised and grown.

Fig. 2. Long Tom.

These advantages, however, lose their force when applied to pots and plants of larger sizes. So soon as the diameter of the plant exceeds that of the pot, the former, not the latter, regulates the distance

between them. But for packing purposes, in which the heads of plants are often tied into less space for travelling than their pots occupy, this gain of space by the abolition of rims would be very considerable. Of course, even then some packing material, such as moss, would have to be placed as an elastic and safe buffer between the pots. But almost the less of this the better for safe transport. In cases of breakages in transit it will generally be found to have arisen from an excess of packing material between the pots, and the nearer to a uniform hardness the entire base of the package can be made, the better and the safer. Hence the packing material can hardly be too thin, as it is there that all the evils and destructive effects of displacement of pots, and the sudden jerks, and other accidents of conveyance occur. The rims of pots also become mechanical obstructions to close packing, and hence it happens, as might have been expected, that a basket packed full of long toms, with a minimum amount of semi-elastic packing between them, will travel more safely than one filled with pots with rims, with double, treble, or four times the amount of packing between them.

Rims are, however, useful for lifting the larger pots, and hence they are likely to be used for such; cultivators having also got so accustomed to rims that not a few consider the rimless ones unsightly. But millions of pots are used for cultural and propagating purposes, the growing of small plants for sale or otherwise, the culture of bulbs, succession pines and plants, and for myriads of other operations in horticulture, in which the appearance of the pots is of no moment whatever.

Not, however, that there is anything unsightly in long toms. On the contrary, as they are exceedingly well made, each pot being as like another as two peas of the same sort, a house filled with plants in them has a charmingly business-like and orderly appearance. As already stated, the plants can be packed so much more closely together, that from five hundred to a thousand more plants may be packed in a very moderate-sized house or frame.

Long toms, like many other so-called and most useful inventions, are rather the revival of an old than the origination of a new idea. Many of the older bulb pots and pine pots of the olden times in horticulture, were almost identical in form with modern long toms. Some of these even carried the depth in proportion to the width to greater length than in the long toms, and it was a notable feature that the deeper they were the less rims they had, as if the rims had been impressed into the service of making them deeper.

The modern bulb pot (Fig. 3), which still survives, though it can hardly be said to be popular in England, gives a fair idea of those very lanky, and, it must be confessed, rather imperfect long toms of those ancient times, in which the arrival of a hundred pots caused greater excitement than the unpacking and safe storage of ten thousand does to-day. These bulb pots may be had in five or six different sizes, from $4\frac{3}{4}$ inches in diameter to 8 inches, and are double the price of garden-pots of the ordinary form. They have the great merit of holding a considerably greater quantity of soil, and of enabling the plants, alike when growing and blooming, to be placed more closely together.

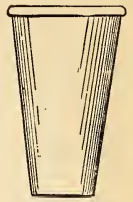


Fig. 3. — Deep Hyacinth or Bulb Pot.

The Oxford.—This is a most useful pot for training purposes, brought prominently into notice and invented by Mr. Matthews. It is made exactly like other pots, with the addition that the rim is perforated (Fig. 4). This is one of the most convenient and simple arrangements for training purposes. So many plants —such, for example, as Pelargoniums, Chrysanthemums, and hosts of others—have to be tied down, that the practical importance of this simple contrivance can hardly be exaggerated. The perforated rim almost abolishes hoop training; and will go a long way towards reducing the numbers, and for many plants will cause the total abolition of stakes. All that is needful is to slip the ties through the holes in the rim, carefully draw down the longest shoots, and proceed to make use of these first shoots as holdfasts for the second, and so on till the whole are trained; or, in cases where considerable tension is needful, the whole of the ties can proceed directly from the rims. In the larger sizes these perforated rims are equally useful for attaching trellises to. The price of the Oxford is one-half more than that of ordinary pots.

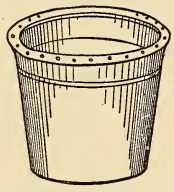


Fig. 4. — Oxford, or Perforated Rim Pot.

The Alpine Pot.—This, in general terms, may be described as a double pot (Fig. 5). Its main purpose is to protect the roots from sudden and extreme changes of heat and cold, wet and drought; aiming, as far as may be, to maintain the roots moist and cool. This is of far more moment in the case of Alpine plants than of any other. For not a few of them in their native homes grow with their feet—that is, their roots—in a bath of snow-water, while they lean their beauteous cheeks against the thick-ribbed ice. Bearing these natural conditions in mind,

it is little wonder that so many attempts to grow these children of the mountain wastes and wilds in pots have proved miserably abortive. With the roots hugging the sides of the pot, now scorched by heat and anon frozen with cold, now parched through drought and again drowning with a deluge of water—the plants, hardy and robust though they be, give up the contest and perish. The Alpine pot protects the roots from these extreme variations and killing vicissitudes of alternating conditions. It is virtually two pots—the inner made within the outer one. The plants are potted in the inner pot in the usual way; and the open space between may then be filled with water, damp sand, or moss, either of which will guard the roots against all extremes as far as may be, and work towards that uniformity of temperature and of moisture most favourable to their well-doing.

Fig. 5.—Alpine or Double Pot.

But the tops of most Alpine plants are as sweet and tempting to slugs and other insect pests, as their roots are sensitive to sudden and severe changes. The Alpine pot combats these dangers as effectively as those of sudden and severe atmospheric changes. By filling the space between the pots with water, each plant is placed in the centre of a little island inaccessible to insect pests, and the cultivator may rest secure that his Alpine favourites are safe.

Only the best pot-ware, however, is fit for this mode of culture, and the surrounding of Alpine plants or pots with a cordon of water as a panoply of safety alike for their roots and tops. Were the pots too porous, the best soil would soon be converted into mud by excessive absorption. With the best ware, it will be found that very little water will be needed by plants thus enveloped with it all round. So far, too, this plan of watering is the best; and during very hot weather, amateur gardeners may safely, and with advantage to their favourites, carry the copying of nature a little further by drafting a few pieces of ice into the water-way around their Alpine pots. Neither must the water be allowed to become putrid. If it is not removed with sufficient rapidity by the compound process of absorption by the inner pot, and evaporation through the outer one, to keep it sweet, then it must be emptied by prompt inversion, carefully spreading a hand over the plant and soil during the process. Sufficient attention is not always given to this, as nothing could be more unnatural or deleterious than semi-putrid water for Alpine plants. The price is double that of common pots of the same diameters.

The Double-rimmed Pot.—This is a propagating pot, and the use of the double rim is to place the bell-glass on this instead of on to the sand or surface in which the cuttings or seeds are placed. It is doubtful if any cultural advantages are gained by this arrangement. But it affords considerably more space, and as the majority of cuttings root more freely against the sides of the pots, the placing of the bell-glasses on the rims would enable the best rooting-places now necessarily left vacant to be fully filled. By filling the rim-space with water or damp sand, the bell-glass will hermetically seal the enclosed atmosphere as effectually as the present mode of placing the glasses on the surface soil of the pot. The use of water as the seal of the air might also dispense with the necessity of watering the cuttings; while, should the moisture prove excessive, sand could easily be substituted for the water.

Orchid Pots, Pans, and Baskets.—These differ from other pots in being, as a rule, of less depth, greater breadth, and more profusely perforated at bottom, and also in their sides (Fig. 6), this extreme porosity or openness being adopted for the double purpose of insuring the most thorough drainage, and also the free passage of the roots from the pots or pans into the atmosphere. The shape or form of the openings in the sides of orchid pots or pans is of little moment; but as most orchid roots are large, and it is of vital importance they should neither be bruised or injured in their exit, nor afterwards, it is very essential that the perforations should be of sufficient size. As orchid pots are specially prominent, it is also well that, especially in the case of suspended pans or pots, they should be ornamental. The potters have been among the first to

Fig. 6.—Orchid Pots.

recognise and anticipate the demand for ornamental orchid pots, and they may now be had of all forms and sizes, and with every degree of perforation, from a few round holes in the sides to latticed diamonded sides or bottoms, as open and porous to water or roots as the older wire and wooden baskets, so well known to all orchid growers. Earthenware, being so much cleaner and more useful and durable than any other material, is rapidly superseding everything else for orchid culture. A few illustrations will show how useful and ornamental these are now made. The price of orchid pots is the price and a

half of ordinary ones; improved ones, with movable bottoms, double price. Pans (Fig. 7) are virtually still shallower pots, arranged for hanging up.

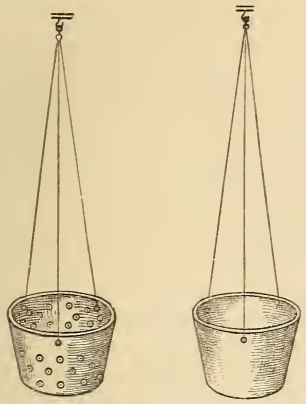


Fig. 7.—Orchid Pans or Baskets.

Glazed Pots.—A good many years ago rather fierce battles on paper, as in practice, used to be waged over the merits of glazed *versus* unglazed pots. And along the entire line the unglazed ware has won the victory. The latter was in fact so complete, that glazed garden-pots are now seldom offered for sale, or made unless to order. The cost is almost double that of ordinary pots, and as they are equally or more liable to breakage, the corresponding advantages, if any, hardly make up for the enhanced cost. They undoubtedly wear cleaner on the outside than ordinary pots, and this is almost all that can be said in their favour. A few authorities here and there prefer them, but the majority shun them as they would the plague. It is doubtful, however, whether this strong aversion is founded on any direct effect of the glazed pots on the plants grown in them. As their sides are impervious, the provision of drainage should be more ample, and plants grown in them need less water than those grown in ordinary pots. When cultivators bear these two facts in mind, glazed pots are likely to prove as successful from a cultural point of view as unglazed.

Colours of Pots.—Good pots, like good horses, are seldom or never of a bad colour, and with cultivators generally all colours are bad but a cheerful bright red, a shade or two lighter than red brick. Part of the feeling against glazed pots no doubt has originated in the colour, so suggestive of common pie dishes or other household ware. Neither have white, French white, nor any shade of stone coloured pots ever been popular. They look to practical men cold, and by these it is said that they are so; and it is without doubt true that, under the same conditions and treatment, plants in white or light-coloured pots seldom do so well as those in red. As for painting pots green, black, grey, or any other colour, all such practices are universally condemned by practical men, and are only indulged in by amateurs to the increase of their risk of failure and loss. The paint stops up the pores of the pot, and converts it at once into a glazed pot of the very worst sort.

It may seem a bold step to vindicate the prevailing colour of garden-pots on æsthetic grounds. But taking into account the prevailing colour of floors, roofs, frame-work of plant houses, and the white glare of the glass, perhaps no colour could prove a more effective contrast to all this, or be better adapted for the effective display of plants in growth and bloom, than the light red which characterises all the best makes of garden pottery.

Pots for other Purposes than Plant-growing.—These are what are called blanching pots, or such as are used for the growth of sea-kale and rhubarb. They are large, deep, and have movable tops

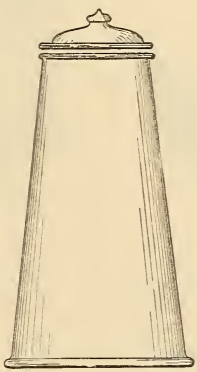


Fig. 8.—Rhubarb Pot.

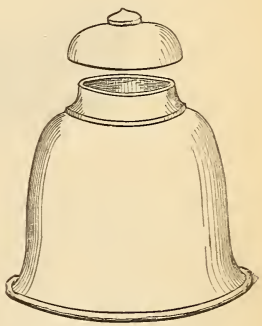


Fig. 9.—Sea-kale Pot, high lid.

to give room for the development of the tops, and afford easy access to the produce when ready for use (Figs. 8, 9).

Though the modern practice of lifting these roots and placing them in heat in the dark has greatly modified and curtailed the old plan of forcing them all out in the open by placing fermenting material around and over the pots on the ground, yet there is still a brisk trade in these useful blanching or growing pots. In the case of rhubarb especially, a month may be gained in time, and the quality of the produce vastly improved, by simply placing the pot (Fig. 8) over the crowns in February or March.

Seed-propagating and other Pans, Saucers, &c.—These are made of various diameters and depths, according to size. The most useful range from two inches to four in depth. The price is about the same as pots of the same diameters, as they are more difficult and take longer to make than garden-pots. Square pans are much more troublesome to make than round, and are on that account more expensive. Their only advantage is that they can be packed closely together without losing an inch of space. Garden-saucers are used for placing under pots to prevent drip and economise water. Unless, however, for such thirsty plants as strawberries in full growth in pots, saucers are now but little used. The base of the pot, constantly standing in water, becomes saturated, the water not seldom rising by capillary attraction till the whole mass of soil is converted into mud. Such mishaps, which have not by any means been rare in practice, have rendered the placing of saucers under pots unpopular.

Fig. 10.—Seed Pan.

Larger saucers, however, prove valuable slug and other insect guards. The pot in these cases is elevated on a small pot, shell, or pot-stand, so as to raise its base right up out of the water; and it is obvious that the entire army of insects are thus baulked in their efforts to reach it by the water. Notwithstanding this side-use of saucers, however, there can be no question that they are going out of fashion. So much is this the case, that it may almost be said—the more pots made, the fewer saucers.

Rustic Terra-cotta Vases, Baskets, Figures, &c.—These bare names, which are far from exhaustive of all that is attempted and done by the modern manufacturers of garden pottery, give but a vague idea of the number and boldness of their designs and the general excellency of their performance within the domain of taste.

Having, as it were, exhausted the art of pot-making on its utilitarian side, not a few makers have plunged headlong into the utmost possible variety of shape and elaborateness of ornamentation; and their success has been so great in these directions as to have run the stonemason, the moulder, and the sculptor rather close on their own lines. Of course, not a few mistakes have been made in this new departure of garden-pottery into the regions of fancy and the domain of taste. Representations of most things in heaven and on earth—and of not a few not likely to be found in either—have appeared. But on the whole the new departure has proved successful, and, by lowering the price of works of art, has made it possible to make some of the artistic garden-pots and baskets almost as beautiful in their way as the plants that fill them. A few illustrations are given here—mere samples of these more fanciful styles of garden-pottery (Fig. 11).

So long as these and others do not interfere with the sterling merits and the real utility of garden-pots, the more varied and beautiful they can be made the better.

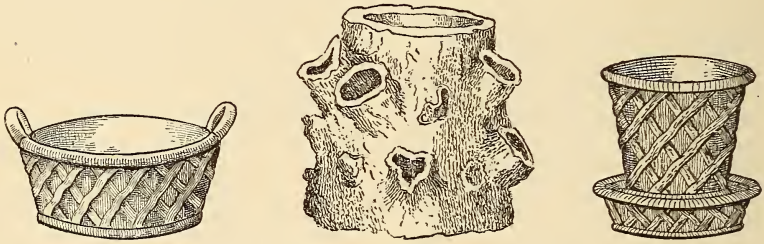


Fig. 11.—Rustic Pots and Baskets.

GROUND OPERATIONS.

LEVELLING.

OPERATIONS upon the ground itself are of necessity the first steps in horticulture, and they sometimes prove so difficult and unpleasant that they also become the last. Properly set about and pushed on, however, few operations afford more healthy occupation, and hardly any good exercise can be made more pleasant; while, as to profit, it may be boldly asserted there can be none without previous operations on the ground. True, at times a field may be found in the open, which is in reality a ready-made garden nature has laid out level, or on a regular incline or slope. The tilth is sufficiently mixed; deep, dry, and rich, it needs neither better form, more disturbance, deeper drainage, or manuring, to grow the most choice vegetable products to perfection. The more we meddle, the more we might mar its quality and spoil its texture. But such fields are rare as swallows in March, or white

sparrows or blue dahlias or blue roses at any season. And hence, notwithstanding the dictum that the land which will grow good wheat or mangold will also grow very excellent vegetables or flowers, it is found by far the best and cheapest policy in the end, to thoroughly remodel and overhaul most ground before it is devoted to garden purposes.

For the fact is that the labour-bill and other expenses of the garden reach of necessity such a considerable sum, that only the best soils yield a profitable return. Never was the penny-wise pound-foolish maxim so vividly illustrated as in the enclosure of gardens by brick walls or other fences, the planting of valuable trees, bushes, or other plants, the sowing of the choicest of seeds, and the devotion of skilled labour to horticulture—all doomed to failure through the poverty or bad condition of the soil. Horticulture handicapped with inferior soil is bound to prove a losing concern. Skill and energy can do and are daily doing very much to vanquish and destroy other difficulties, such as those of an uncertain climate, the constant assaults of foes, and hindrances of all kinds. But when the earth is in league against the cultivator, he must and does surely fail. Taking it therefore for granted that certain ground operations will be needful, it will be useful to describe the most important, and to give as plain and clear instructions as possible for their proper and prompt performance. The chief are the levelling, trenching, draining, digging, and ameliorating of the ground.

Levelling does not mean that every kitchen or flower garden or lawn is to be converted into a dead flat. Nothing could be in worse taste, or lead to less profit, than such dead seas of unproductive and unsightly uniformity. Inequalities of surface, causing inclines less rather than more steep towards the sunniest and consequently the most genial point of the compass, are among the most potent causes of augmented fertility and increased yield. The term "level," as used here, is synonymous with evenness of surface, and even that need not be too rigidly enforced, for some of our best gardens are so uneven, and lie on such steep inclines, that the heavy rains convert the walks into torrents, and carry the gravel pell-mell before them to the lowest points of the walks; while summer showers of unusual severity not seldom bear crops and surface tilth away bodily also, reminding us of the farmer on the blowing sands in East Anglia, who found his barley field, that he had sown over-night, blocking up the drift-way from hedge-top to hedge-top the following morning. But, of course, such steep inclines are far from desirable—they may insure early crops, or mature fruit on walls that could not be otherwise grown in the climate or locality, but they have many drawbacks. The crops may be washed out or burnt up, and are not infrequently subjected to something approaching to both catastrophes in turn, while the labour of transporting manure, removing produce, and of cultivating the land, is almost doubled. All such unlevel sites should, if possible, be avoided. Of course, the erection of boundary-walls of hot-houses, and other buildings, is greatly simplified and much facilitated if the garden is or can be made level, or to fall gently to the south, south-east, south-west, west-south-west, or even, though that is not so desirable, north-west.

The most Common Mistake in Levelling.—This important and vital operation, on which so much of the future success or failure in any given garden so largely depends, is too often left wholly in the hands of architects or builders. The result is that the surface is laid level or smoothed over, at the sacrifice of a portion, and not seldom the whole, of the surface soil. Now, as every tyro in rural affairs knows, this soil is not only the best, but very often the only soil of any possible use or value. Nevertheless the mere mechanical leveller throws it here, there, and everywhere, into any and every deep rut or depression, just as if it were nothing worth. Why, with hardly any figure of speech, that surface tilth may be defined as fragrant roses, crisp celery, sweet cauliflower, luscious peaches, in another and not very distant form. And yet in how many gardens in the course of formation, has it been degraded to the level of mere ballast or builder's rubbish! sold to surface other gardens with a few inches of presentable soil, that lures so many amateurs to their bitter disappointment in horticultural pursuits; screened to make sand for mortar in the running-up of contract houses, or virtually stolen by speculators; the barren subsoil alone being left for the future owner of the tempting suburban or villa residences, so tellingly posted up and alluringly described as "self-contained within their own grounds." Why, the ground proper has been cleared out years ago, almost as clean as a hungry dog picks a bone, and instead has been placed the vilest possible compound of dead subsoil, brick-bats, and builder's rubbish, about as barren and as utterly useless for horticultural purposes as the same depth of the old or new red sandstone.

Neither has this robbery, denudation, and degradation of surface been confined to the immediate neighbourhood of great and populous cities. Not a few of the noblest mansions in the country have had the surface of their grounds destroyed for some considerable distance by the overspreading of the subsoil dug out of the foundations all round the house. The stuff was on the spot, such as it was, and the cheapest way to get rid of it was to raise the

ground-level into a terrace or artificial wide promenade with the worthless diggings. And the fertile surfaces have been entombed where we least expect it, and barren earths without either texture or strength substituted for them.

Testing the Depth and Disposition of Surface Soil.—It is impossible to exaggerate the importance of this precaution. The dangerous leap in the dark of some landscape gardeners and civil engineers, who will begin to level ground without first testing its quality, is about the most reckless and wasteful expenditure of time and money. Small test-holes, about half a yard square, at intervals of ten or more yards apart, will generally furnish sufficient information, and guide the proceedings of the leveller.

It is one of the most mischievous popular errors to suppose that the surface soil, or tilth as it is called, will be found of one uniform depth throughout. As well might the geologist expect the rocky strata to overlay each other with as much regularity as a pile of books on their sides on a shelf or table, without any tilting whatever. The surface soil, alike in depth and quality, is one of the most variable factors in this world of change. It is no business of the mere leveller to exactly determine its quality, though the more correctly he can read off that at sight, the better for him and the quality of his work. But he can measure its depth, and so estimate its mass, as to calculate with approximate exactness how far it will cover the entire area of the garden to a uniform depth. The following formula, which is tolerably correct, furnishes a useful guide in the practical levelling of gardens:—An inch per acre requires about a hundred cubic yards or tons of earth. Further, a common cart-load is about a ton.

Even where art has not disturbed the surface soil, it is astonishing how greatly its depth and quality vary in places near to each other. It is difficult to account for these wide variations, whatever theory of its manufacture and deposition be adopted. For its infinite gradations of depth remain almost equally mysterious, whether we attribute its formation to atmospheric influence, or primitive rocks or subsoils, the rise, progress, and decomposition of vegetables, or the direct and active agency of earth-worms. If the latter have formed the mass of surface soil, how came they to be more numerous in one place than another, and that before the surface soil had been deepened?

Leaving this, and kindred subjects concerning the formation and arrangement of surface soil, for special treatment by itself, all that concerns us here is the levelling of soil and subsoil, so as to have the surface or vegetable mould of one uniform depth throughout.

Level Subsoil and Surface Soil Together.—At the same time, so vitally important is it that the subsoil should be levelled, that the advice to level it first of all would be given, were that possible. As that cannot be, the levelling of the two should proceed as nearly abreast as practicable. The surface reveals its own inequalities, but it is only by the use of test-holes that the inequalities of the subsoil can be discovered. It is too often taken for granted that the surface tilth will be found of one uniform depth throughout. There are, however, dips in the surface mould as well as in the subsoil and lower strata; and it is most important that the garden modeller or moulder should make himself acquainted with their existence. They will enable him the better to calculate on the depth of surface soil generally, and how much of the subsoil, or other, will be needed to impart to the garden the most desirable depth of working soil, or surface mould. Having collected these data,

Fig. 1.—Ground Dug out to Level Surface Soil and Subsoil together.

and taken the level by some of the simple processes about to be described, he may then proceed to remove the surface soil bodily from a space of ground three or four feet wide, carting or wheeling it away to the other side of the piece of ground to be levelled. The next operation is to dig out or remove a sufficiency of the soil to allow of eighteen inches, two feet, two and a half, or three feet, for surface earth (see Fig. 1). During this process see that the subsoil is formed of the same shape, with exactly the same incline, as the surface. As soon as this is done, proceed to operate on another space of three or four feet, of exactly the same area. In moving this one to the opening, as it is technically called, it should be manipulated in such a manner as to thoroughly mix the surface soil, subsoil, and new earth, if any added; that the surface mould should be a careful admixture in proper proportions of the three or more earths used in it. It is impossible to lay down any strict rules regarding the relative proportions used; so much depends on the poverty or richness of the old surface mould, on the sterility or semi-fertility of the subsoil, and on the quality of the new earth added. Sometimes the existing soil is so rich and deep that neither better compost nor any considerable portion of subsoil need be added. As a rule, however, both will be necessary to get anything like a proper depth for horticultural purposes; and it is seldom that any subsoil is so absolutely barren, useless, or positively injurious, but that something like a sixth portion might be incor-

porated with the soil : whereas a full half of maiden surface soil added to that on the spot, will generally be found of the greatest service, and render it far more valuable for all horticultural purposes.

But the subject of deepening will recur under the head of " Trenching," and the chief point here is to insist on the necessity of so levelling the subsoil, either by bodily removal or incorporation with that on the spot, that the surface soil should cover it everywhere to the same depth. Those most conversant with the economical performance of ground operations will see that this levelling process should combine the merits and advantages of trenching, digging, and manuring as well. After levelling the subsoil it should be loosened to a further depth of six inches or a foot with a pick or spade, a layer of manure spread over it before the layer of surface soil, and more added during the process of filling up with the mixture of the different earths. But not a few level first, and it is for these chiefly that the advice is so often repeated to level soil and subsoil abreast at one operation and the same time.

Simple Modes of Levelling.—Levelling on a large scale is an important branch of civil engineering, and requires a theodolite, and other expensive instruments and appliances. It is not such ascertaining or alteration of levels, on a large scale, that is referred to here, but rather of inequalities of surface or of fall over a few acres at the most. The majority of gardens are either on a dead flat or an even fall, and so far as the kitchen garden is concerned it is desirable that they should be so.

Most fields, on the other hand, before being taken in for gardens, are more or less uneven, and as a rule it is not desirable to perpetuate these inequalities, and hence the importance of having some simple means of removing them. So many words, figures, and diagrams have been expended on this subject, with the result of frightening people away from it rather than teaching the art of levelling their own garden, that one almost fears to approach it.

In most gardens the starting or standard points are already predetermined for the operator, the house

Fig. 2.—Straight-edge with Level.

or mansion on the one hand, and the park, fields or surrounding country, public or private roads, and so forth, on the other. The problem is thus much simplified, for few operations can be more simple than the making of ground between two points perfectly level, or on an even regular fall all the way. The only implements needed are a measuring-rod ten feet long, marked into feet and inches all the way, a straight-edge (Fig. 2) or triangular foot level (Fig. 4), a quadrant (Fig. 3), three borning-rods, a bundle of straight stakes, either with or without cross-bars, movable or otherwise, at the top, some smaller stakes, and a mallet.

In levelling such an irregularly-shaped piece of ground as Fig. 5, place a row of stakes at equal dis-

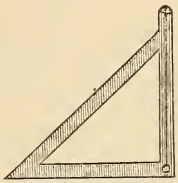


Fig. 3.– Quadrant.

Fig. 4.—Triangle-level.

tances of ten or twelve feet along its surface, and of any convenient height. Having placed the first two in position, take the straight-edged spirit-level (Fig. 2), place it on the top, and see that they are made exactly level. Then drive a third in, and level it to a dead level with the second, and so with

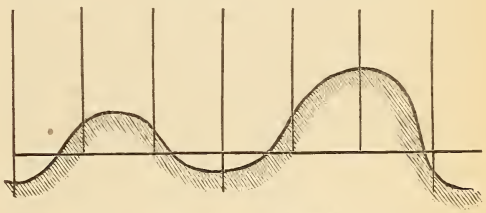
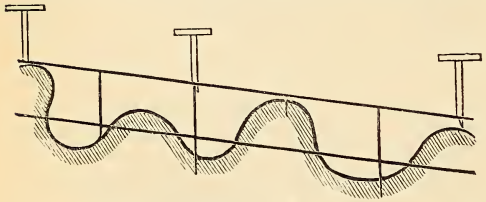


Fig. 5.—Levelling with Stakes and Rods.

the fourth, and all through to the end. This will form a level line at any handy distance from the earth, the exact height being in no way material. As the slightest mistake becomes of material importance in a long line, it is desirable to test the level by sighting it over a quadrant, or by sighting on a second level, reversing the end of the level between every pair of stakes. Two points must be specially noted at this stage. The gauge for forming a level surface is already provided by the level line on the top of the stakes, and it is quite clear that by measuring the same distance down from the top of each stake, the earth-line would be as level as this line in the air. But the second point is, where is the surface line of the garden to be? This can be settled thus:—Measure the distance from each stake to the original surface, and set the distance down, and so on with all the other stakes throughout. As the ground varies in height less or more at either end, it is better, for the sake of greater accuracy, to measure the two ends separately, add the product, divide by two, and set down the half under the other

heights. As of course it would not be fair to count both ends in reckoning the number of measurements, this product of the two end stakes will only count as one. Add the different heights, divide by their number; the product will give the mean or average height throughout. Measure down each stake by this mean and level up to it, and the surface of the ground will present a true level.

Levelling with Borning-rods.—This is still more rapid and simple than the method already described. Borning-rods are upright stakes or splinths, from two to three inches broad, and from three and a half to four feet in height, the exact height varying to suit the stature of those who use them. Cross-bars are fixed against the rod at exactly right angles with it, so that the cross-bar forms a horizontal line as far as it goes, the stake being perpendicular with it. Two of these stakes should be of exactly the same height, and one, or what may be called the sighting one, about an inch taller than the other two. On this, and exactly at the same height from the ground, a small sighting-hole should be bored, at an equal distance from each end of the cross-bar, and an inch from its upper surface. This should be very small, and after making should be burned black with a hot iron, to make and keep it perfectly clean. This sighting or borning-rod is fixed in the earth at one end of the ground to be levelled, and another fixed



Borning-rod.

Fig. 6.—Levelling with Borning-rods.

at the other end. (See Fig. 6.) Then a man or a boy distributes stakes all along the line to be levelled, which ought to be kept quite straight between the two points, and places the third borning-stake on to the ground, or a stake driven into it. When, on looking through the sight-hole, the tops of the other two can be seen at once, the borning-rods are either level or at an even fall. The process of placing the third borning-stake is repeated along the line at distances of ten, fifteen, or twenty feet, as the case may be, and when completed, the line of earth or of stakes on which they rested indicates a level, or an even fall. In places where the earth is too high, it must be removed, and the stakes driven in till the top of the borning-rod lines with the sight-hole and the top of the fixed stake at the other end.

This mode of levelling can be done with tolerable exactness with rods of equal length, without the sight-hole; but that simple contrivance makes the matter much easier; and if the work is carefully done the level or fall is absolutely perfect. The light is apt to confuse the eyes, as it flashes on the cross-bars of the three borning-rods at once, whereas, when seen through a sight-hole, the third can be set in line with the other two with absolute certainty, and far greater ease and rapidity. The cross-bars are best painted white, with half an inch of black from the top downwards. This simple mode of levelling is invaluable for the making of walks, the laying down of box or other garden-edgings, the levelling of lawns, the determining of the regular fall of drains, or any other purpose where a simple, easy, and expeditious mode of levelling is required.

It is always desirable to drive stakes firmly into the ground in this mode of levelling, as these serve the double purpose of forming a ground-line parallel with the top of the borning-rods, and of leaving a permanent guide for the men to work to in moving the soil. In cases of considerable irregularity of ground, the labour of digging to the proper level may be avoided, and the stakes themselves made to serve a double purpose, by starting the stakes a foot or so higher than the ground is intended to be. The process of levelling with the rods proceeds just as before. The tops of the elevated stakes are level, or on an even fall, and by measuring a foot down on each, the line of the ground is found. In cases of even greater irregularities, the highest points of the ground may be taken as the starting-level for the borning-rods, and the desired level may be found by measuring to the ground-line, and finding the measure as already indicated by Fig. 5.

There are many other means of levelling ground, but none more simple and efficient, and therefore none better, nor likely to be of more general use to readers of a work of this character.

FLORISTS' FLOWERS.

By Richard Dean.

INTRODUCTION.

THE distinctive term of "florists' flowers" represents now, with a larger meaning than it did a quarter of a century ago, a group of subjects, some of which have for many years past been taken in hand by persons specially interested in them; and cultivated, as well as improved, with great care, mainly for the exhibition table. The annals of floriculture are prolific of records showing how workers in various positions in society, but mainly

in the humbler walks of life, have taken up one, two, or more subjects (such as the Auricula, Carnation, Pink, and Tulip, among others), and cultivating them with the greatest care, saved seed and raised seedlings; selecting with intelligence from these only such as were manifest improvements upon the varieties known to them, and rejecting all others as inferior types unworthy their attention. Such cultivators have invariably worked by certain rules, which have come in course of time to be known as "properties" or "points," and which were eventually formed into a code by some who had a clearer insight into what were deemed to be the requirements of quality in flowers than others. Thus an authoritative statement of the properties of florists' flowers was made known and accepted by the large body of florists, and acted upon as if they had the authority of an Act of Parliament. When these laws or properties in their more elementary character began first to shape themselves in the minds of florists, we cannot say; but as developments of their favourite flowers occurred, experience gave them a broader application. They were for a time unwritten, yet generally understood. By-and-by, when the necessity for a more accurate and complete exposition became necessary, they were codified, and the "Philosophy of Florists' Flowers" became a phrase current among florists. A few of the properties held to be desirable may be mentioned by way of illustration:—The circular petal; thickness of substance in petals; purity of the white ground, where it occurs as a base; density, brilliancy, and unity of any prominent shade or hue of colour; regularity and perfection of the feather on the edge, or the flame in the centre of the petal of a Tulip; the circular edge, the dense, well-defined zone of body-colour, as well as the thickness, purity, and smoothness of the paste in the Auricula. These, with others of greater or lesser importance, serve as illustrations of what not a few modern writers are apt to term the artificial and arbitrary laws set up by the florists. Now-a-days they are being considerably relaxed; but in bygone days they did undoubtedly work out great and important results in the case of many popular flowers, which went altogether beyond the most sanguine expectations of the pioneers of the floral movement, though their faith in time was large.

In so strenuously insisting upon the requirements of the code of properties, the florist, during the last forty or fifty years, made such striking advances in the attainment of size, stoutness of texture, symmetry of form, and comparative perfection in the arrangement and distribution of colours in flowers like the Auricula, Carnation, Dahlia, Hollyhock, Picotee, Pink, Ranunculus, and Tulip, not to mention others, that it appears difficult to advance much beyond what has been attained. The florist is now accused of having developed flowers so formal, and so geometrically correct, that everything almost has been sacrificed to form: the grace of natural beauty having been overlooked.

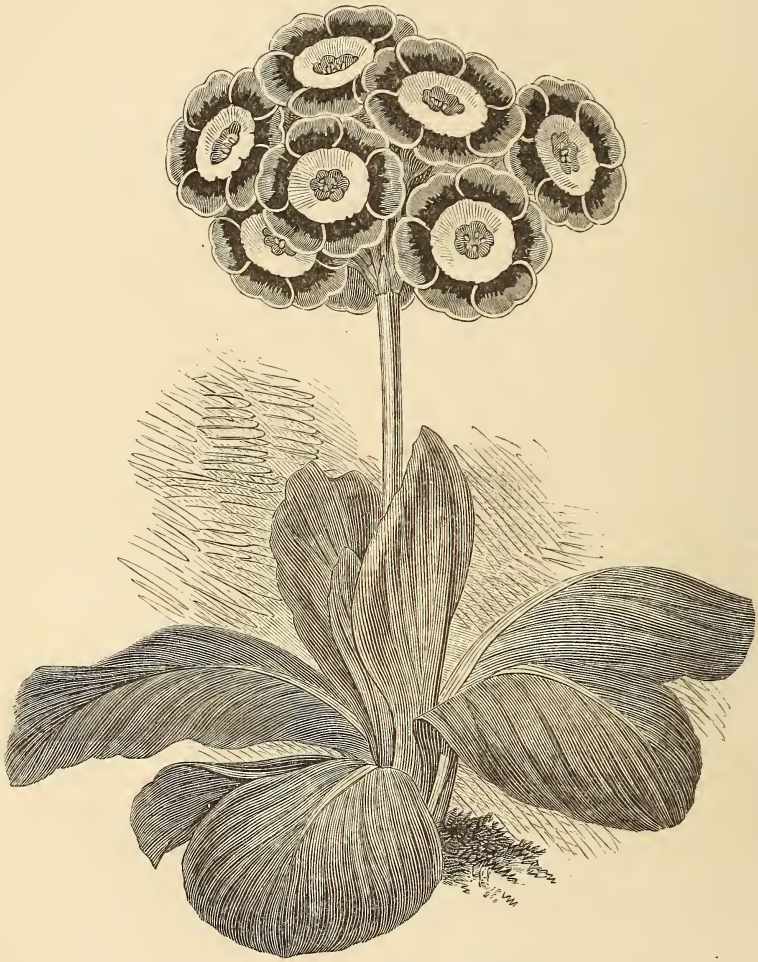
The chief objection is, however, rather that he has set up a standard of his own, without always sufficient reference to the natural conformation and purpose of the flower. Instead of striving to develop and accentuate its distinctive features, all of which are important as landmarks in the history of the flower and its relation to outward circumstances, the florist often ignores these in setting up his own ideal, to which he endeavours to make the flower conform, applying to each and all, in spite of their diversity, much the same rules. It would be affectation to deny that the result is very beautiful, but it sometimes lacks the highest beauty—that of *truth*—and thus destroys the significance and evidence of purpose and adaptation, which are as dear to the intelligent observer as mere symmetry of outline, or harmony of colour.

As a kind of reactionary movement, a great deal of attention has of late years been given to the development of the eccentric and fantastic in not a few florists' flowers, so called; and with these new breaks have been associated other properties of size, substance, form, and striking colours; but upon many of these, the florist of the older school looks with undisguised contempt, and considers them as altogether unworthy of his care. But narrow as are his views in the estimation of some, he knows nothing of finality in relation to his work. He has an unfaltering trust in the possibilities of nature; his ideal continually recedes as he reaches nearer towards its attainment, taking on new features of beauty and fitness, and inciting him to renewed efforts to realise the better and eventually the best.

One result of this floricultural enterprise was the establishment of a large number of small exhibitions of flowers in many parts of the country, where cultivators of certain subjects could meet, put their specimens into comparison, and receive premiums for the best. These shows sprang up with marvellous rapidity in and around London, and especially in Lancashire, Yorkshire, and other of the Midland and Northern Counties. The Flemish and French weavers, who many years ago were driven from their own country by religious persecution, brought with them their Auriculas and other flowers. Settling in London, Lancashire, and elsewhere, they cultivated them with assiduity and success; and intermarrying with those among whom they came to reside, spread abroad a love for their flowers, and a desire to cultivate them. At Middleton, near Manchester, quite

a colony of these Flemish refugees formed a settlement; and to this day florists' flowers are largely grown there, and frequent exhibitions held.

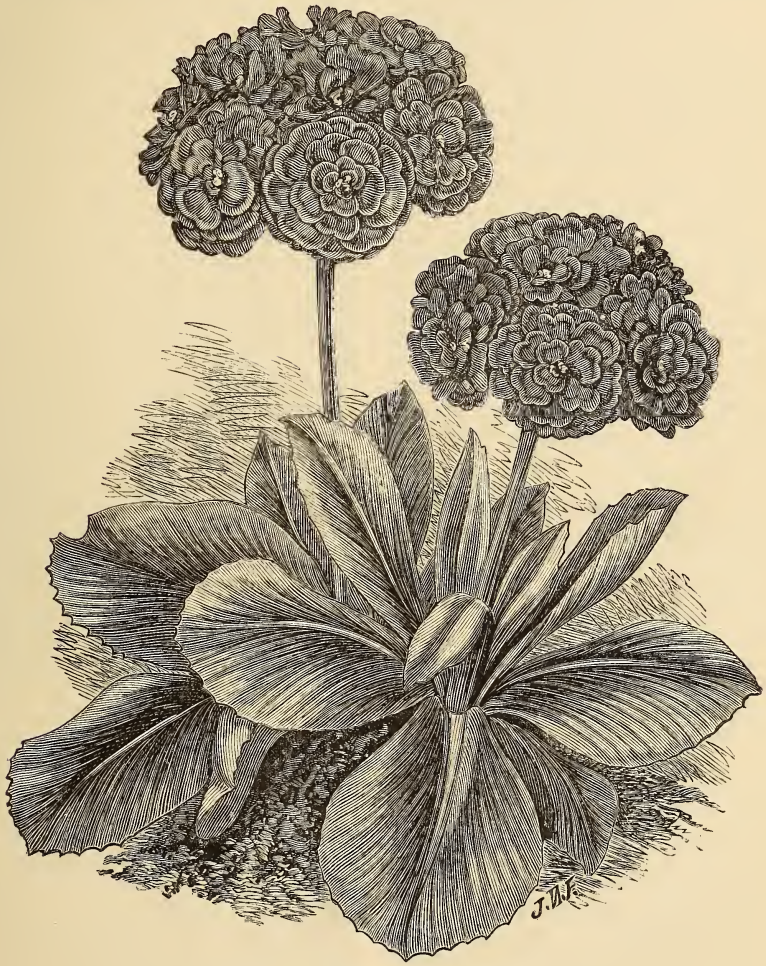
Thirty and even fewer years ago, these exhibitions were a necessity, as they were the only means by which florists could interchange views as to the best modes of cultivating their favourite flowers. They were then as much of a social as of a competitive character, and when the task of awarding prizes had been performed, the florists sat down, and over pipe and glass talked for hours about their floral pets. In those days a new variety of known quality of any popular flower, when a sufficient number of plants had been obtained, was "let out" at one of these meetings, each purchaser paying for and taking home his plants. With the establishment of a horticultural press came more enlarged opportunities for interchange of opinion on plants, and the best modes of culture; and this new vehicle brought into notice many other plants outside of those then known as florists' flowers. The Rose, among others, became highly popular; the "bedding-out system," as it is termed, began to attract public attention; and the consequence was that some of the most valuable of the best-known florists' flowers declined in public estimation. The improvement in the culture of fruits and vegetables, and the introduction of many new varieties of each, also



Show Auricula (Variety C. E. Brown).

operated to draw attention away from the flowers dear to the florist; old growers of repute died, and there were none to fill their places. The Tulip, Anemone, Ranunculus, Hollyhock, and a few others, have in these days almost gone out of cultivation, though there are still a few valuable collections of the first to be met with in the Midland Counties, and particularly in Lancashire. Thirty years ago several fine collections of Tulips were grown near London; now there is scarcely a remnant of one to be met with.

And, as showing that in the world of flowers there are revolutions of opinion and sentiment similar to those which occur in the realms of thought and speculation, it may be remarked that the "single" form of the Dahlia, which the florists of the past generation laboured so hard to develop into a symmetrically-shaped, full, and approximately perfect "double" flower, has become one of the most popular of the floral pets of the day, and admirers of these look askance at the large, well-formed double Dahlias the florist loved so well. The rapid growth and wide development of a taste for floral decorations, which is one of the prominent social characteristics of the present day, has had a great deal to do with originating a preference for "single" flowers, as being more elegant and graceful for table and general home decoration. The single Chrysan-



Double Auricula Purpurea.

themums also appear likely to be preferred to the fine double forms, and destined to receive a share of the popular favour given to the single Dahlia.

But there is such a thing as "fashion" in the world of floriculture, as there is on the broader stage of our social life. One of these appears to be taking the shape of a renewed interest in some of the old florists' flowers. For a few years past, exhibitions of Auriculas, Carnations and Picotees, Dahlias, and Pelargoniums have taken place annually in London. The Auricula is receiving special attention, and the circle of cultivators of this charming flower widens every year. There is a decided tendency towards an enlarged culture of *hardy* flowers, and not a few of the prettiest and most useful florists' flowers come under this denomination. At present the two most popular of our hardy florists' flowers are the Rose and the Chrysanthemum; but others will surely rise up to a higher level of popular appreciation before long. Information respecting many neglected subjects is eagerly inquired for; and when this activity is apparent, it is certain that a new era of popularity is in store for some of those fine old-fashioned "Stars of Earth," neglected for a time, but which the flower-loving public will not willingly let die.

The Auricula.—Some years ago this was very happily described by an old florist as a "beautiful and fascinating flower." It is so in every sense of the word. But, unhappily, it has come to be regarded as a flower that can be successfully cultivated only by proficients, and much that has been written respecting the Auricula has tended to deter rather than to encourage lovers of this flower to attempt its culture. It is a flower that the amateur should take in hand, for if only the necessary attention be paid it, it can be grown with comparative ease. Nor is it necessary, as some have said, that it should have a pure, sweet, untainted country air, though this is a decided advantage; for we have seen collections of Auriculas in thickly-populated, smoky districts of Yorkshire and Lancashire, growing freely and flowering finely: indeed, it is a subject that can be grown in the neighbourhood of cities and towns where many other things would fail. It does not require much space to be grown in: an ordinary glass frame, with the bed raised above the ground-level so as to secure, as far as possible, a dry bottom; or a small house on a north or west aspect, will suit the Auricula well when grown in pots; and we have seen in towns pots of Auriculas standing on the outside sill of a basement window—large, vigorous, healthy plants, flowering with great success in spring. Let no assumed difficulties, therefore, dissuade any one from attempting its culture. We have seen in Lancashire a few plants growing in odd corners, where it would scarcely be believed they could exist, but tended with loving care, and this attention neutralising all the disadvantages of position.

Classes of Auriculas.—There are two distinct types of the Auricula, viz., the show, or edged and self varieties; and the Alpine varieties. There is no doubt they are both derived from *Primula auricula*, but how and when the divergence between the two types became so marked is beyond our knowledge. The main distinction between the two consists in this: that while the show varieties have a dense meal—a farina-like substance—round the tube, which comes off at the slightest touch, and which is termed the paste, the Alpine varieties are meal-less. There are green-edged flowers in which the edge is destitute of farina: the grey and white-edged flowers have meal on the margins, in lesser or greater abundance, and between the paste and the edge there is a zone of colour, which is termed the body: the self-flowers have a broad marginal colour round the paste—yellow, mauve, blue, purple, maroon, or black—and this extends to the edge. The Alpine varieties have a great variety of shades of colour; some are self-coloured, some are beautifully shaded, some have white, some cream, some pale yellow, and some deep golden centres, the last being very handsome. There is a class of Alpine Auriculas known as "laced," a delicate and beautiful strain, with distinct and well-defined pale margins to deeper colours defined with marvellous regularity. These are of Continental origin, but improved by English florists. There is also a very interesting class of double-flowered Alpine varieties, but they are in but few hands, and at present restricted in numbers.

Propagation of the Auricula.—The Auricula is increased in two ways: by means of offsets thrown up from the main stem, and by seeds. Some sorts of show varieties throw up offsets much more freely than others; almost all the Alpine varieties make offsets in plenty. As soon as these growths have made roots, they should be carefully removed, and potted singly in small pots, using a light sandy soil; or several may be placed round the sides of larger pots. And as they make roots, they should be shifted out into larger pots, taking care not to over-pot, and to give the pots abundant drainage. In this way an increase of stock can be secured. New varieties can be obtained by seeds. The sooner they are sown after becoming ripe the better, filling pots, pans, or shallow wooden boxes with rough siftings about half-way up, and then adding fine soil of a light sandy character, which should be pressed down firmly until the surface is quite level, and the seeds should then be scattered very thinly over the surface,

and be pressed into the soil, adding a very thin sprinkling of silver sand or charcoal dust. A piece of glass should then be placed over each pot or pan, and these stood in a cool frame or green-house, where the seeds can be shaded from the sun when necessary. Auricula-seed germinates slowly, and at irregular times; and seeds sown in the autumn will sometimes lie in part until the spring before there are signs of germination. Some do not sow until the spring; but when it is convenient, it is decidedly advantageous to do so as soon as the seeds are ripe. We may here remark that seeds taken from the finest edged flowers will produce Alpine varieties; and those who are doing their best to improve our varieties of show Auriculas generally do not care to grow Alpine Auriculas. Some of the Lancashire and Yorkshire florists raise their seed in a remarkable manner. They take large pots, half fill them with crocks, on which they place a layer of cinders, and fill up with the very fine ashes taken from a blacksmith's forge. The pots are stood in pans of water, and a piece of glass placed over each. The seed germinates much more rapidly than under the older system of sowing; but it is necessary to prick off the young plants as soon as they can be handled, or they are in danger of dying off. The strongest seedling Auriculas will flower in fourteen months from the time of sowing; the remainder not until the following spring. As soon as the tiny plants are large enough to handle, they need to be pricked out into pots of fine soil, a dozen or so in a pot. When they have grown sufficiently large, the plants can be put three in a pot, or potted singly into small pots to flower. Any one caring to have a choice collection should reject all flowers of poor quality among the seedlings, and retain only those that are improvements, or at least equal to existing varieties.

A common error with growers of the Auricula is to over-pot. This is a mistake, as the plants do better when the roots are in a reasonably confined space. The best pots for good-sized plants are those known as forty-eights; these are about four and a half inches in diameter measured inside. Smaller plants need smaller pots; and the sooner the roots have penetrated to all parts of the soil, the more satisfactory will be the condition of the plants.

Potting is generally done in June and July, when the plants have done flowering and before they make their summer growth. The soil should be prepared some time previously, and should be composed of the following:—good fibrous, clayey loam, from an old pasture that has lain by and become thoroughly rotten; this should be broken up quite small before using. With this mix a fourth part of decayed cow-manure, or, if that cannot be had, the same quantity of decomposed manure from an old hot-bed, adding some charcoal and enough silver sand to keep it open. This should be used when it is thoroughly mixed together, and sufficiently moist to cling together a little, but not be wet. The plants must be turned out of their pots, all the old soil shaken out, and any decayed portion of the tap or main root cut clean away; any offsets or side growths from the roots or main stem should be removed and put round the sides of small pots. Potting should be done somewhat firmly, and when finished the plants should be kept in a close frame for a few days, and no water should be applied for two days. Then it should be carefully and gradually applied.

The best position for Auriculas during the summer is a cold frame in a shady place; on the north side of a wall or thick fence is one of the best positions. At the end of September the frame can be placed in the open, facing the south. It is a good plan to raise the pots above the ground-level; it is not so necessary in the case of a shallow frame, but advisable to have the plants as near the glass as possible. In the case of severe frost it is also necessary to cover up the frame with mats; and it is as well to keep the soil in the pots pretty dry during the winter, as the plants are at rest. In February it is the custom to top-dress the plants, using some rich soil for the purpose. The reason for this is, that the plants put forth roots near the surface in spring, and some fresh soil is applied for the young roots to work in. A portion of the old surface soil is carefully removed, and the fresh soil put in its place. But the top-dressing of Auriculas is not so much followed as it was, and some of the leading growers for exhibitions dispense with it altogether. And they are found dispensing with rich composts, and use turfy loam in which Cowslips will grow: some friable leaf-mould from the woods, and a little rough stream or silver sand. Those who grow choice collections of Auriculas now build small houses, so that they can go into them and enjoy their flowers at all times; and they sometimes heat them with a flue or hot-water apparatus, which, while it keeps frost from harming the beautiful flowers, also helps a fine development. But it is by no means necessary that artificial heat should be applied to the Auricula at any time during the year.

The choice named Alpine Auriculas need to be treated in the same way as recommended for the show varieties. But being generally of a hardy character they do well in the open ground, such as the shady side of a bank, or shallow rockwork. Inferior varieties—that are, however, too good to be thrown away—can be planted out in this way. The new laced Alpine varieties are singularly pretty, and so attractive that they are well deserving of cultivation.

Selections of Auricula.—The following are the most noteworthy varieties:—

SHOW AND EDGED VARIETIES.

Green-edged.	*White-edged.*
Anna (Trail).	Acme (Read).
Mrs. Moore (Douglas).	Beauty (Trail).
Rev. F. D. Horner (Simonite).	Glory (Taylor).
Colonel Taylor (Leigh).	John Simonite (Walker).
Freedom (Booth).	Conservative (Douglas).
Lycurgus (Smith).	Lady Sophia Dumaresque (Lightbody).
Prince of Greens (Trail).	Silvia (Douglas).
Talisman (Simonite).	Regular (Ashworth).
Grey-edged.	*Selfs.*
Alexander Meiklejohn (Kay).	Blackbird (Spalding).
C. E. Brown (Headly).	C. J. Perry (Turner).
Confidence (Campbell).	Clipper (Turner).
Dr. Horner (Read).	Heroine (Horner).
George Levick (Walker).	Ellen Lancaster (Pohlman).
George Lightbody (Headly).	Lord of Lorne (Lightbody).
Lancashire Hero (Lancash.).	Pizarro (Campbell).
Richard Headly (Lightbody).	Ruby (Read).
Victor (Read).	Topsy (Kay).

ALPINE VARIETIES.

Amelia Hartwidge (Douglas).	King of the Belgians (Turner).
George Lightbody (Turner).	Mercury (Turner).
Sailor Prince (Turner).	Mrs. Ball (Turner).
Unique (Turner).	Napoleon III. (Turner).
Colonel Scott (Turner).	Phœnix (Turner).
Diadem (Gorton).	Slough Rival (Turner).
John Ball (Turner).	Topsy (Turner).

Of double Auriculas, the black and yellow are well known. Purpurea (purple), and Delicata (primrose), are both very fine, with large double flowers, and other striking types are being raised.

The laced varieties have not yet reached a stage of development to admit of named varieties being put into commerce; but seed can be had anywhere.

THE LIFE-HISTORY OF PLANTS.

By DR. MAXWELL T. MASTERS, F.R.S.

GROWTH, SEEDS, BUDS, ETC.

THE degree of excellence at which practical gardening has arrived must be attributed mainly to the accumulated teachings of experience. Every gardener, be he professional or be he amateur, has to learn his business mainly from experience. No amount of book-learning or help from others can supply the want of this quality. This truth it is which leads unreflecting persons to uphold what they call practice at the expense of what they consider theory, and, as they imagine, to confound all opponents by the statement that "an ounce of fact is worth more than a pound of theory." Such persons do not trouble themselves to consider whether their so-called facts are deserving that name, or whether what they conceive to be theory is rightly so entitled.

Experience, whether gained by the individual himself—the most valuable of all—or whether handed down as a tradition from his predecessors, is in any case only the result of conscious or unconscious inference from observed phenomena. The observation may be correct, it is almost certain to be incomplete; the inference may be just, it is almost certain to be faulty. A perfect theory implies the elimination of all error, whether of observation or of inference. Such a consummation is rare indeed in any science, and unattainable in any department of natural history. But in a practical art like gardening it will, at any rate, be admitted that the more perfect the observation and the more correct the inference, the more valuable will the experience and the practice founded upon them be. This being so, the necessity of knowing something of the nature of

Fig. 1.—Slice through a Lily-bulb, showing the conical growing point enveloped in a number of fleshy scales, from which it derives its nourishment in the first instance, and the roots which help to supply food when that in the scales is exhausted.

the plant, and of the way in which it lives, feeds, breathes, grows, propagates, dies, will at once be admitted, and will serve as our excuse, if any be needed, for devoting some space to the life-history of the plant; in other words, to its general structure and to the work which its several parts individually and collectively do, and to the means whereby that work is either helped or hindered.

Were science perfect, it is probable that every detail would be found of more or less direct practical importance; but in its present fragmentary and imperfect state there are whole departments in which we either know little or nothing definitely, or in which imperfect observations and conflicting views necessitate further study and discussion on the part

of the practitioner in the laboratory, before they can be made safely available for the guidance of the practitioner in the garden. For full information as to the existing state of structural botany, or of those departments of chemistry and physics which are inseparably bound up with the physiology of plants, the reader must consult the standard text-books. All that we can do here is to call attention to the leading phenomena of plant-life, as observed under conditions in which they are brought under the notice of the cultivator in the course of his ordinary routine.

Growth.—As we have to trace the record of plant-life from day to day in due sequence from its beginning to its end, it matters little at what part of the cycle we begin; but as growth is the most striking phenomenon observable at the time when these pages come before the reader, it may be appropriate to begin our remarks with that subject. The propriety of this will strike some so forcibly that they will naturally think no other course than that of "beginning at the beginning" would be correct. And this is no doubt the case; but, unfortunately, we do not know where to fix the starting-point. Neither the seed nor the bud can be strictly considered as beginnings—seeing that they are merely *remanets* from last season's growth.

Practically, however, we may take them as starting-points, in which the activity of the plant chiefly shows itself, after the rest and relative cessation of work of the winter season.

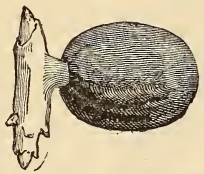


Fig. 2.—Germinating Seed of *Canna*, showing the black seed-husk, and the seedling plant protruding its two growing points, one upwards to form the stem, the other downwards to form the root (slightly enlarged).

Reserve Organs.—Sharply-drawn definitions are not applicable, except to a very limited extent, in any branch of natural history or physics. One thing is always wholly or partially inseparable from some other thing. The several parts act and react upon one another, so that anything like an absolute line of demarcation which shall hold good in all cases, at all times, and under all conditions, must not be looked for. Hence, when we say that the seeds and buds, and their modifications, with which we are now principally concerned, are "reserve organs," it must not be inferred either that they have no other office, or that no other parts of the plant can fulfil the same duty.

Fig. 3.—Bud of Horse-chestnut surrounded by scales, the outer of which are becoming shed by the growth of the growing point within.

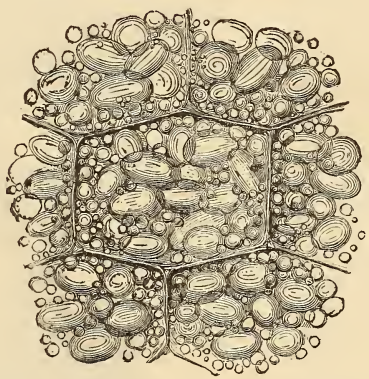


Fig. 5.—Portion of the Perisperm of the Seed of Wheat, highly magnified, to show the food-store in the shape of grains of starch.

Fig. 4.—Section showing the Seedling Plant of *Canna* surrounded by the food-store in the perisperm (enlarged).

Fig. 6.—Section of Seed of Date, showing the hard, horny perisperm from which the minute embryo (shown in the centre and close to the upper edge) derives its nourishment.

Both seed and bud (we are speaking especially of leaf-buds) contain a "growing point" in their interior, but the growing point of a bud, or of a bulb (which is only a form of a bud), remains attached to the shoot from which it originated, and grows principally in one direction (Figs. 1, 3); the growing point of a seed is detached entirely from the seed, and grows in more than one direction (Fig. 2). The growing point of a seed is, in fact, the germ or embryo plant which, on its escape from the seed, becomes the seedling.

But in either case the growing plant is surrounded by a protecting investment in the shape of the husk of the seed, or the scales of the bud (or other device having the same object). With that protecting investment we are not greatly concerned now; it is not in itself a centre of activity at any time; and now that we may assume it to have done its work, it is no longer of service, and is discarded either by gradual decay or by being pushed off by the constantly increasing growing point within (Fig. 3).

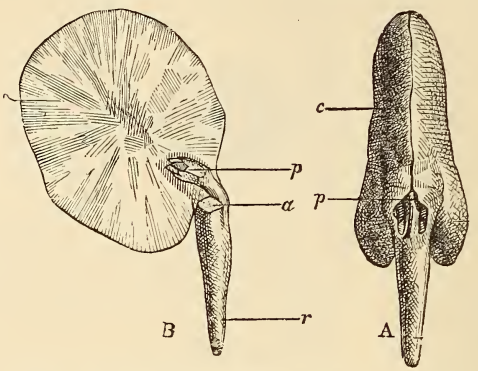


Fig. 7.—Seed of Broad Bean after removal of the husk, to show the embryo without any perisperm, but with large fleshy seed-leaves or cotyledons, in which food is stored for the use of the growing plant. In A, the line at *c* points to one seed-leaf, and *p* to the plumule or growing point of the stem. B shows one seed-leaf removed; *r* is the growing point of the root; *a*, the scar formed by the removal of the seed-leaf; *p*, the plumule.

The Perisperm.—Beneath the protecting husk, in the case of the seed, is very frequently to be found a mass of tissue generally of a white colour and floury appearance—this is called technically the "perisperm" of the seed (Fig. 4). Sometimes it is called albumen, but this latter term is objectionable as conveying an altogether erroneous notion of identity with the chemical substance of which the white of eggs furnishes a familiar example. The perisperm is filled with starch grains, and other materials suitable for the nutrition of the growing point. This is the substance which constitutes the bulk of the wheat-grain, and which is ground up to supply our requirements (Fig. 5). Another familiar example is the flesh of the cocoa-nut, which also is filled with food destined for the benefit of the young plant, if it be not previously requisitioned for the requirements of mankind. The hard bony stone of the date (Fig. 6) and of some other palms (by no means to be confounded with the stone of the peach or the shell of a filbert), affords another illustration of the perisperm, filled in this case also with food for the embryo plant.

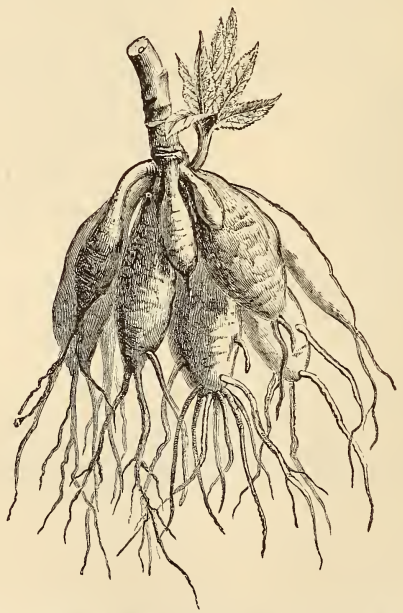


Fig. 8.—Tuberous Root of Dahlia, serving as food-store.

The nutritive power of the perisperm is well illustrated by some curious experiments of Van Tieghem, who removed the embryo plant of the Marvel of Peru (*Mirabilis*) from its bed of perisperm, and fed it not only with artificial nutritive solutions, but also by portions of the perisperm bruised and laid over it. The embryo plant grew almost as well under this system of artificial nursing as under natural conditions.

But such seeds as those of the pea and bean have no perisperm; their embryo plant is immediately invested by the seed-husk without the intervention of any perisperm (Fig. 7). In these cases it will be found that the embryo plant itself is large, and its tissues filled with food-matters. Thus, while the embryo plant or growing point of a date-stone is no bigger than a pin's head, that of the pea or bean occupies the whole of the seed; the plant in this latter case carries its store with it.

The seed of an orchid is very minute, and is equally destitute of perisperm. It is so small that there cannot be much store of nutriment within it; hence it is clear that it must be enabled to shift for itself from a very early period, or it will dry up and die; while the other seeds we have mentioned are not under the necessity of obtaining supplies from without, unless it be of water, till after their own stores have become exhausted. An examination of different

seeds from the points of view we have named will at once supply the grower with a hint as to the method of treatment most appropriate to them.

Buds have no perisperm to draw upon for their supplies, but they have nutritive matter stored up within their tissues, and they have a still more abundant supply in the bark and young wood of the shoot from which they originate.

The thick root of the carrot or turnip contains a supply available for the growing bud, which forms the crown; the thick fleshy root-stock of such plants as the Solomon's Seal (*Convallaria*), the tuberous roots of dahlia or orchis (Figs. 8, 9), the tubers of the potato (Fig. 10), the fleshy stems of cactuses (Fig. 11), the fleshy scales of the bulb, also contain much nutritive matter available for the support of their growing point. In the corm of the crocus, the old corm serves as a storehouse for the new growths.

We have now to see in what way that store is rendered available, and what circumstances influence it—matters of the greater moment, seeing that the food as it exists in the perisperm or tissues of the bud or seedling is insoluble, and quite incapable of serving as food until it has been in some way rendered soluble, and capable of being digested and assimilated.

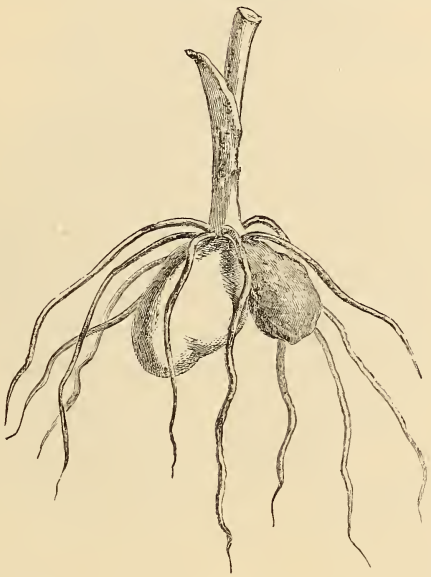


Fig. 9.—Tuberous Root of Orchis, serving as food-store.

Germination.—It hence appears that the bursting of the seed to liberate the enclosed seedling, the unfolding of the scales to let loose the young shoot, are phenomena dependent on a gradual change in the nature of their contents—a change brought about, in the first instance, by the absorption of water, or at least by the transfer of water from one part to another, under the influence of the increasing heat of the soil or of the atmosphere. It cannot be the result of the more intense light of the lengthening day, for the seeds grow beneath the soil away from the access of light, and the buds or eyes will sprout in the darkest cellar, as every one who stores potatoes knows to his cost. On the other hand, every gardener knows what a little "bottom-heat" will do to start his seeds or buds into growth.

Increasing heat, then, is the prime mover in starting seeds and buds into growth, if the water supply from within or from without be adequate. The amount of heat required is different in different cases. Hardly has the soil of the Alps or of the Arctic regions become loosened from the grip of frost than growth commences. In other cases, nothing cooler than the temperature of a hot bath suffices to stimulate either bud or seed. Each plant grows best at a certain temperature; high in one case, low in another. What that temperature is, the physiologist fixes precisely in the laboratory, and the practical cultivator approximately by means of his experiments, aided by what he may know beforehand of the source whence the seed was derived, and its probable requirements. Under natural circumstances, in temperate countries, the heat of the soil, treasured up from last summer's sunrays, is always greater during the winter than that of the atmosphere, so that in many instances a very little additional heat in spring suffices to incite the dormant activity of the plant.

We are now brought face to face with the question, What does the heat do? In reply, it may briefly be said that it disturbs the balance both of the solids and of the fluids of the plant; it expands the gases; it causes currents in them and in the fluids; it provokes chemical action; it necessitates the absorption of water. What is the result of all this, we shall have to consider further on.

The absorption of water is the most important of these early stages (provided the bud or seed have access to oxygen gas, as it would always have under ordinary circumstances). This absorption of water is rendered evident by the increased *size* of the seed or bud, an increase beyond what could occur at so early a date from any growth, were that possible. The water may be derived from without, or it may in the first instance be simply transferred from one portion of the bud, bulb, tuber, or seed, which has much, into another portion which has little, no living portion ever being absolutely destitute of water. This movement of water, either from with-

out or from within, is checked by too low or too high a temperature, the most favourable temperature varying with different plants and under different circumstances. The absorption of water, however, may be more fitly dealt with hereafter, under the head of "Root-action."

Digestion of Reserve Food.—The conversion of the insoluble and indigestible reserve matters into the soluble and digestible food-material is a very marvellous and a very intricate process, one only imperfectly known, and one to which we can only incidentally allude. It must suffice to say that it is effected by the action of a substance called "diastase," which exerts its action only when the juices of the plant are acid. Lately it has been shown that certain extremely minute organisms or germs, commonly known under the general term of "Bacteria," act on starchy matters in the same way as diastase; indeed, it is stated that they secrete a ferment identical with, or having the same properties as, diastase. The fatty and oily matters contained in some seeds undergo corresponding changes, and are converted by the agency of a nitrogenous ferment from an insoluble to a soluble condition.

Conditions requisite for Germination.—Sufficiency of moisture and of heat, together with access of air, then, constitute the chief essentials in the germination of the seed or the sprouting of the bud. These facts, coupled with an examination of the nature of the seed, large or small, thick-husked or thin-husked, with or without perisperm, and a knowledge of the climatic conditions of the country from which it comes, furnish the reasons for the care taken in practice to prevent the germinating seed from getting too dry, or too cold, or too deeply buried in the soil. On the other hand, they furnish suggestions as to the best method of preserving seeds, and of transporting them from distant countries. These are points which will be further dealt with under the head of "Seed-sowing."

Not so well known to practitioners are the means whereby germination may, in some cases, be hastened and facilitated. In the laboratory it is found that solutions of chlorine, iodine, and bromine favour germination, and this is accounted for by the fact that water (consisting of hydrogen and oxygen gases combined) is decomposed; as for instance by chlorine under the influence of light forming hydrochloric acid and setting oxygen at liberty, which "nascent" oxygen, as it is termed, is forthwith appropriated by the growing seed as a powerful stimulant and as food. On the other hand, the application of anæsthetics, such as ether or chloroform, arrests germination for a time, the process being resumed after the effects of the vapour have passed off, provided the dose be not so strong as to destroy vitality altogether.

Fig. 10.—Tubers of Potato, serving as food-store.

Vitality of Seeds.—The length of time during which seeds can retain their vitality is very variable, being dependent on the conditions under which the seed is kept, and on the nature of the seed itself, as may readily be inferred from what has been already said. Generally speaking it may be said that oily seeds lose their vitality sooner than starchy ones, owing to the greater readiness of the oil to decompose. Even under ordinary circumstances there is great variation as to the duration of the time for which seeds of different plants will preserve their

vitality; and this will not surprise the gardener, who knows how frequently seeds of the same plant —*e.g.*, *Primula japonica*—sown on the same day, and under apparently identical circumstances, germinate at very irregular intervals. In any case, the reader will do well to exercise scepticism as to the tales of extremely prolonged extension of vitality, as in the case of the so-called mummy wheat, such cases being usually attributable either to faulty observation or wilful imposture.

Fig. 11.—Stem of Cactus, the swollen tissues of which are laden with nutritive material.

THE KITCHEN GARDEN.

By William Earley.

SITE. SIZE. SOIL.

THE kitchen garden, being that wherein vegetables and indeed fruits are grown for domestic uses, is necessarily an essential and important department. It is intimately associated with the economy of "home," and is, like all divisions of the garden, a luxury, having the advantage of being, when properly utilised, self-supporting. In view of its great usefulness, and that it is indispensable, far more consideration should be given to its formation, &c., than is customary, in regard to site, proper apportionment of size according to the demands likely to be made upon it, soil, shape, disposition, &c. When proper deliberation or study is not given to these matters, the result is likely to prove a perpetual source of irritation and disappointment, to say nothing of real loss. A kitchen garden entailing only the needful amount of labour can be made highly productive, where these considerations are given effect to in connection with its formation. Too frequently it is the practice, in connection with building new houses, for the architect to choose the site of the garden without bestowing any thought upon these needful considerations; whereas, those versed in such matters should always be consulted, in order to obtain the best-arranged whole.

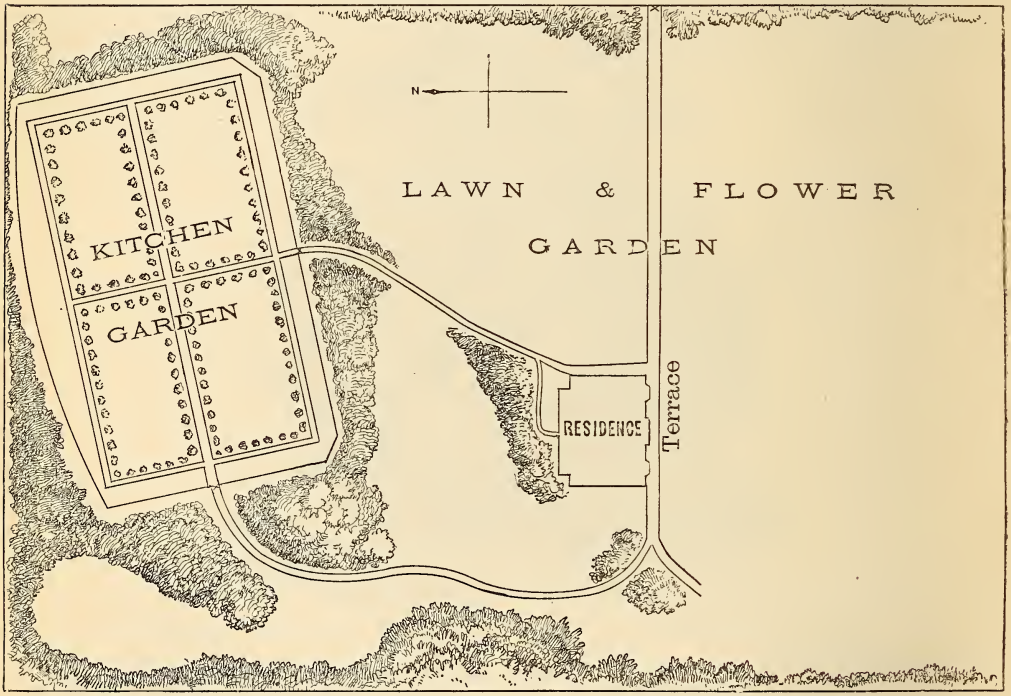
The Site.—Considering this in relation to the house and the other parts of the residence, the site of the kitchen garden should be one convenient of approach therefrom, through and beyond the flower garden, or an ante-garden devoted to floral embellishment, possessing agreeable features. It should also be so arranged as to be convenient to the stable-yard, from whence an entrance should exist, in view of obtaining and utilising such materials as are usually carted from thence into the garden.

The aspect due south is always desirable, in view of securing more favourably the sunshine of the early spring months. Level ground is most convenient generally, though a site having somewhat

undulating slopes is capable of producing, by proper culture, excellent crops in kind. These simple facts show that the situation should never be in front of the residence, nor immediately in the line of view from the chief windows.

It is desirable, so far as possible, to secure for the crops immunity from direct north and east winds. This is an important factor connected with the growth and production of winter supplies, and very early crops of young spring vegetables. Where the choice of situation can be made, it is highly desirable to avoid as far as possible low-lying spaces or valleys. This from the twofold fact that colder subsoils generally abound, and late spring frosts prevail; both of which cause injury to early crops, the former being very injurious besides to the roots of perennial vegetables wintered therein.

A source of advantage and profit is always to be found in the possession of an abundant supply of water in connection with this department. When-



Kitchen Garden to north-east of Residence; planned so as to catch the greatest amount of sunshine.

natural conformation of the land in the immediate neighbourhood does not give this, or plantations do not exist around, high fences or walls should be constructed. These latter are all but invariably associated with this department, owing to this necessity in a measure, but also from the other important one of choice fruit supply. By growing such things together, all can be more certainly secured, and in the most economical manner possible.

I have thus far treated the subject from the point of view that areas of limited extent most generally prevail. Where large mansions exist, however, and in connection with them extensive grounds, from ever a neat pond can be formed, it is a very desirable feature, especially when the garden is formed midway upon a sloping ground, enjoying the happy mean of being between the higher-up ground, where too full exposure to cold north or easterly winds exists, and the lower ground so subject to cold in spring, with the drawback of cold subsoils, and sour soil generally. Such a pond should be artificial in construction, of oblong or ornamental shape, formed by water imprisoned in its descent from the higher to the lower grounds. From such a source, water in the best possible state for periodical summer waterings, obtained in the handiest possible manner, is under command, very

different from that, so cold and hard, which is laboriously brought thither from wells.

To summarise the above explanations, it will readily appear that all considerations attached to grounds of limited extent as a whole, decide the fact that the kitchen garden should, if possible, be situated north or eastward of the residence. By this arrangement, fruit, or protective fences, walls, or tree screens, &c., will act beneficially in regard to such residence. Besides, the approach to it will be "set off" to great advantage, by having the most cheerful aspects, and their varied garniture in form of crops and trees, facing both the residence and the more direct approach (see illustration); whereas a kitchen garden at the western side must be approached and entered to a disadvantage in these respects, to say nothing of the fact that all space south or west will be far more eligible for flower garden, lawn, and shrubberies.

Size.—The extent of the kitchen garden is to be determined by the extent and habitual requirements of each family. It is important also to consider whether other arable land exists, in connection with the estate, whereon some of the common, albeit most important crops so essential to household uses can be grown. These consist of potatoes, turnips, and such other very hardy subjects as could be most successfully grown as main crops, leaving only early supplies to be furnished from the garden itself. Where no such aid exists, more space whereon to grow these things should be allotted. It is surmised by many that the potato supply is as cheaply purchased as grown. This is not so, however, where a proper system of successional cropping is carried out.

To form a kitchen garden possessing the utmost usefulness in produce, and pleasing in appearance, it must be so laid out that good walks exist for enjoyable pedestrianism, and easy access and working. Small side-wall and side-walk divisions or borders should be formed, whereon, in the former case, to winter and produce early crops, and sustain the roots of fruit-trees grown against the walls; and in the latter case, to grow bush, espalier, and pyramidal fruits, the lesser kinds of herbs, &c. A garden thus neatly arranged will occupy more space than an ordinary piece of vegetable ground; and it should not be less, supposing potatoes, &c., be grown for the main crop, than an acre in extent, if it is to furnish all the supply for a moderate-sized family maintaining an establishment of dependents. The question of labour has also something to do with this matter. It is universally admitted that one man's time will be fully occupied the year round upon one acre of kitchen garden. Upon this basis a proper calculation can be made on this score: a calculation, when desirable, which should always be made in conjunction with flower and pleasure gardens and glass structures. Nor should the fact be overlooked, that it is *economical* to possess a glass structure, whether for fruit or otherwise, where labour can be economically maintained in activity during inclement weather, &c.

Neat and effective kitchen gardens, including bush fruits, &c., may be arranged in connection with villa residences upon a space comprising half an acre of ground. It is always desirable, however, to exceed requirements rather than limit the space, where the real supply of a family is contemplated. Additional fruits, &c., can always be grown, which in themselves are a minimum tax only on the labour bill. Rising from the villa garden up to ducal kitchen gardens and requirements, a variety of sizes exist in the country, up to as many as ten or twelve acres. It has been held that a rood of ground will produce a supply of vegetables *pur et simple* for four persons.

But much may be done far short of supplying the entire necessities of a family. A few choice or early vegetables out of "one's own garden," fresh, not only seem to, but really do taste different to any other; and not a few manage, by dint of skill and close cropping to get most welcome, and what almost seem ample supplies out of the tenth or twentieth part of a rood. By successional and what is called express cropping, that is, the driving of two or more crops abreast on the same land at the same time, an amazing amount of produce may be obtained from a few square yards of ground in the course of the season. But such small-size kitchen gardens, which are intimately connected with allotment gardens, averaging one or two rods in extent, require comparatively quite as much supervision as do those of greater extent. The chief object in regard to all is to grow the greatest quantity possible of excellent crops. There is no good tangible reason why all the best kinds of hardy vegetables should not be produced by owners of vegetable ground very limited in size. For instance, Asparagus, considered so very difficult to grow, and so great a luxury, is as easily grown as any crop, and should be essentially an amateur's plant; and more especially if its culture be undertaken on the modern principle advocated by advanced growers during the last few years, *i.e.*, united row culture, rather than the older plan of separate beds and their attendant expense. Two or three rows sown across even an allotment space will give constant crops by means of such simple preparation only as will be found under the head "Asparagus." Besides, the space may be conveniently utilised to grow early lettuces upon, providing always the seeds are sown very thinly, and plants grown so also. By these

means such superficial-rooting plants do not injure the bed or the permanent crop, especially if the annual surface dressings of manure are given as advised.

In small gardens, herbs and minor subjects may advantageously occupy the outer sides or edges, and all corners. A regular system of successional cropping can conveniently be maintained with great advantage, and in some instances, especially on light soils, one crop may be made to follow another with very moderate cultural outlay. For instance, the onion-bed, well manured, when it has produced its summer crop, will only need hoeing deeply before autumn-sown cabbage plants are planted thereon. They will succeed better upon such soils, so treated, than when digging is again resorted to in view of planting. Certain kinds of very nutritious vegetables, such as beet and Jerusalem artichokes, are not so generally cultivated in small gardens as, from their prolificacy and merits, they should be. In the planting or disposition of crops, even in small gardens, such tall subjects as the last should be planted at the northern side as nearly as possible, in view to not unduly shade crops of more lowly stature. Again, as regards such small gardens, too little heed is given to the matter of aspect. All plants in rows should be grown from north to south, rather than from east to west. This is especially desirable in connection with peas and potatoes; thereby the two sides will have equal sunlight or sunshine, which they do not receive by the latter plan.

Again, and in spite of what is said above, it is a mistake to endeavour, by too thick planting, to reap *excessively* heavy crops from limited spaces. Numbers never give bulk in proportion equal to proper limits of such, and where each plant has power to develop fully. This is particularly noticeable in connection with root crops. And to limit the supply of manure is, especially in the case of heavily-cropped small gardens, false economy. The too common thought, that land will suffice to carry a current crop without it—that, in fact, it will do until next season—should never be indulged in. By placing a dressing upon such forthwith, both the present and future crops receive benefit.

Too much also cannot be said in favour of artificial waterings in connection with small gardens. Such waterings, as otherwise explained, must, however, be given studiously to the roots, and at regular intervals, to insure really beneficial results.

The Soil.—The soil is an all-important consideration where choice can be made. Subject to the aspect, ground conformation, altitude, &c., referred to, a sandy loam of moderate consistency is preferable. This under culture will always, when of a goodly depth, or not less than two feet deep, resting on a porous subsoil, give the best results. Not only does such a soil possess the requisite fertility, freedom for root action, and mechanical cohesiveness, but it is also characterised by more warmth in winter, without excess of latent moisture at any season. It also has the very important advantage that it will work freely in a day or two after excessive rains, which is an immense advantage.

Unfortunately, however, occupiers of a majority of large detached residences, villa houses, &c., are subject to many influences which determine where land is most eligible to build houses upon, quite irrespective of considerations as to the adaptability of soils to gardening purposes. The result is that houses are built indiscriminately in this respect, not unfrequently on the poorest of thin soils, &c., requiring much labour and expense to bring them into an indifferent state for any such purpose.

Thus occupiers have variously shallow soils and light; heavy soils with deep pans of impervious clay for subsoil, and many intermediate classes: a consideration which enforces reference to each separate class herein.

Shallow soils, resting upon a gravel subsoil, may be by heavy manuring converted into excellent media for late winter, spring, and early summer crops. The addition to them of any stiff loamy or clay-like soil will also prove a great advantage. Practically, a different system of working should be followed to what is requisite in connection with other grades of earth. Manuring, as suggested, should always be applied very liberally, and, as far as possible, throughout the entire depth of the upper soil. The all-important fact in connection with the latter is, that it should be applied and the soil turned over as long as possible before crops are planted. By these means the manure will enrich or thoroughly impregnate the interstices, and the early digging or "working" will have been done in time to insure such a mechanical firmness as is essential to root-growth, and the greatest possible retention of latent moisture. To dig up such grounds during or anterior to dry weather periods is to cause them to dry unduly, to the lasting injury of any permanent crop which may be sown or planted on them. In connection with such light soils, too much cannot be advanced in reference to surface mulching and artificial waterings. To secure the utmost profit possible from both, however, they should be used as far possible together. For instance, a surface mulching with fine manure, applied to peas, dwarf and runner beans, cauliflowers, lettuces, onions, &c., over which artificial waterings are poured during dry intervals, not only gives direct support and fertilising powers, but the mulching secures

the surface soil from being sunburnt subsequently, and retains the artificial moisture applied during very arid periods.

All heavy adhesive soils—and these usually have for base impervious and heavier subsoils—must be properly drained to insure to them all the fertility possible. Such drainage differs in practice greatly, both as to depth and nature of subsoil and contour of the immediate area to be operated on and its surroundings. Where about two feet in depth of upper soil exists, and then a clay subsoil, this latter, called sometimes a "pan," through which superficial waterings do not pass, is sometimes of moderate depth only, before a coarser material is found, through which water will percolate. Under such conditions it is well to trench the ground over down to this

Fig. 1.—Artichoke.

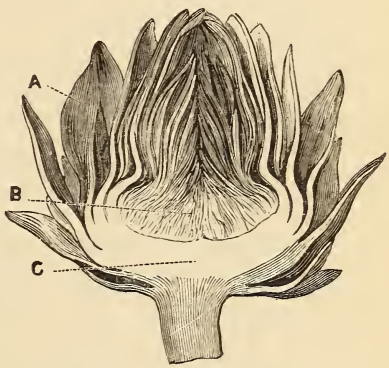


Fig. 2.—Section. A, leaves; B, the "choke;" C, the bottom.

subsoil, clearing it effectively of soil, and to then break it up by digging and turning it over at the bottom of the trench, before it is filled in with the succeeding layer of soil. When broken up it is excellent practice to throw in any kind of coarse or green manurial matter before any soil is put therein. In all instances where the surface soil is of less or equal depth, and the subsoil is too deep for such a process as this to be followed, an occasional drain laid in across the ground down upon such surface of subsoil will prove very advantageous. Where the roots of fruit-trees do not exist, or are not likely to find their way into such drain-pipes, large sizes need not be used; two-inch and three-inch pipes will suffice admirably, the larger size being best adapted for large areas only.

The superficial "working" of all stiff soil differs greatly from such as have already been described. Too much culture cannot well be given to these latter in season. Trenching and manuring—that is, placing layer after layer of the latter as each trench progresses—is admirable. The merit of such a practice is readily seen when it is understood that many minor-sized products root very deeply. For instance, the onion often protrudes its roots down to a depth of at least six feet. Strawberries root deeply also, to say nothing of parsnips, long carrots, and permanent crops of brassica, pea tribes, &c. In a word, all such plants root more or less deeply, according as natural roadways or feeding-grounds exist, throughout which they are enabled to travel more or less freely.

In the case of heavy soils, working them up, whether by trenching or the more generally applicable practice of digging and forking, aërates and ameliorates their heavy, too-binding, cohesive, moisture-retaining characteristics during rainy periods, and so excessive in moist seasons, and the harsh hardness prevalent during arid ones. Unlike light soils, therefore, these last cannot be worked too freely or too frequently, and, save in one particular instance, too immediately before actual cropping takes place; this exception being, digging them up when dry during an arid period for the purpose of planting upon immediately. In such a case it is preferable to wait for at least some quantity of rain to fall before the operation is undertaken. Frost being so great an ameliorating agent, it is essential that all such soils be turned up during the winter months. This should be done as roughly as possible, in ridges or otherwise, so as to expose the largest surface possible thereto, as the more this is frozen during the winter, so much the readier will it work in the spring, and the smoother it will be when required for the reception of crops.

Many intermediate substances may be usefully applied and added to heavy soils with great and lasting advantage, comprising sands, road-scrapings, burnt earth, &c. All kinds of manure are also especially advantageous in this respect, quite apart

from their more fertilising capacity. Very rough or crude manure, in admixture with straw, &c., buried at a depth therein, will cause air to be imprisoned along with it, which will prove invaluable.

Between the two extremes of very light and heavy soils, many intermediate grades exist, superior, free, rich sandy loam standing midway. Each will have to be treated on the above bases, in accordance with its exact constituents. Certain crops have a great power in correcting harsh or over-tenacious soil, owing to the system of summer culture needful in connection. Amongst these are Jerusalem artichokes, potatoes, celery, &c., all of which may be advantageously employed as correctives in connection with new gardens.

Wherever new gardens have to be formed upon pasture or turf land, it is highly desirable to dig the surface turf into the ground, as it possesses root nutriment of the very highest order.

Referring to the highest order of kitchen garden ground, which should be secured in connection with all large gardens where excellence of produce of all kinds has to be studied rather than outlay, the soil should never be less than three or four feet in depth, and when taken in and arranged, it should be forthwith trenched over to its extreme limit. In connection with such gardens it is a great advantage to secure different soils in separate parts of the garden. By these means a greater variety of superior vegetables can be grown. Nor is it desirable in the case of well-expressed undulating surfaces to level all down, as to do so will cause too shallow soil in certain places. Independently of the several aids to soil amelioration previously referred to, sea-sand is an excellent medium in connection with all heavy soils, and may be intermixed with such in far greater bulk than is customary. Sea-weed may also be brought into inland gardens, and worked into the ground with very great advantage. Burnt earths, thinly but evenly intermixed in all soils, are very beneficial, and incite active root-growth extensively, proving a source of great help during the winter months and at other seasons, when rains are in excess. Occasionally a red or mineral tint appears in some forms of stiff soils. Such are "fox-bent," and contain an excess of iron. The only corrective of such is frequent working over and exposure to the air, and good dressing with fresh-slaked lime triennially. This should be dug up with and thoroughly intermixed in the soil, along with such additions of other foreign subjects as are recommended above.

Generally speaking, yellow loams are preferable to dark or hazel, being more recently broken up from primæval field or forest. Their texture, both from a fertile and mechanical point of view, is far superior. Dark soils, such as exist in old gardens, require heavier manurings than others. It is well also in their regard to apply a little lime occasionally. It is in this case not only a corrective of sourness, but hastens also the solubility of mineral substances. An excess of lime is, however, injurious to soils in any case: especially where the ground has to be looked to for permanent crops indefinitely. All very strong, hot, and dry soils will at all times be benefited by the addition of a little chalk, broken finely, where readily obtainable.

THE CULTURE OF VEGETABLES.

The cultivation of vegetables for culinary or edible purposes has improved very rapidly of late years, all classes showing, under a studied and assiduous system of culture, a remarkable development of such portions as are required and are nutritious, whether these consist of the root-base, the leaves, blossoms, or fruit, some of each coming under this head. We shall give the most improved methods now practised in connection with the several popular kinds, with brief and practical lists of a few of the best varieties for the amateur, reserving hints as to successional cropping and other details of general management for later articles.

Artichoke (*Cynara Scolymus*). German, *Artischocke;* French, *Artichaut;* Spanish, *Alcachofa.*—This is a perennial plant from Barbary and the South of Europe, cultivated more as a luxury, certainly, than for profit. The flower-heads when full-grown, but still quite young, contain the only edible part. This consists of that portion of the fleshy receptacle (the base of the bloom) which adheres to the stalk and the base of each scale; in other words, the bottom of each flower-head when it is cut away from the stalk. Cooks divide the head in their phraseology into (A) the leaves, (B) the "choke," and (C) the bottom (see Fig. 2), of which only C and a portion of A are eatable. The plant is distinguished often by the name Globe Artichoke, and is entirely different from the "Jerusalem" Artichoke, the tubers of which are alone edible. It delights in a deeply-cultivated and enriched sandy loam soil.

Seeds sown upon a sunny, open site during the month of April will germinate and produce fine heads of flower, if properly thinned out, when necessary, the same season. Such seedling plants transplanted during the following spring months also form permanent beds.

Transplant into rows, somewhat elevated or mound-shaped, three feet apart, and two feet apart in the rows or between each plant. Such plantations will remain in bearing three or four years.

New plantations are also made during the months

of April and May in each year, by removing strong young suckers or side-growths from around the base of aged plants or "stools," transplanting precisely as advised for seedlings above. The flower-heads are fit for use just before they show symptoms of opening so as to show the actual florets within. The heads cut when young, but of good size, will keep for a short time in a cool place. Subsequent attention required by them consists of occasional hoeing during summer, the removal of the lesser blooms upon stalks which grow more than two, and the cutting away of such stalks immediately the crop is secured. During the month of October cut away many of the aged leaves, and place a few inches of tree-leaves or other protective litter around them and over the root-base. Remove this protection early in the month of March of the following year. Select three or four of the strongest shoots from amongst the many to be found upon each plant, and remove all others. To do this, remove some of the soil from each plant, and cut the useless ones out. Place a layer of manure over the roots exposed in the process, and replace the soil over such in its former place, using the finest to place between and immediately around each young shoot so retained.

Two distinct varieties exist, known as the Green Globe and Purple Globe. The former is more conical-shaped than the latter, and is known as the "French" variety.

Artichokes, Jerusalem (*Helianthus tuberosus*). French, *Topinambour*. — The origin of the name "Jerusalem" as applied to this plant is hidden in doubt, though it is most generally inferred that it is derived from *Girasole*, its Italian name. The plant is a native of Brazil, but is perfectly hardy in Britain. It flourishes in and deserves a rich loamy soil. When grown in such the tubers produced are beyond comparison larger and better than such as are obtainable in the too customary slip-shod manner of growing them.

No better plan can be followed in planting sets than such as is so universally practised in connection with the potato. No kind of manure should, however, be applied to them at any stage of growth. It causes excessive stem and leaf growth at the expense of large and good tubers. Small or medium-sized tubers should always be planted. For this reason it is better to cut large ones in two, and plant halves only as single sets. Planting may be done in October, or during February and March. It is important, however, not to defer this operation until too late. Spring growth cannot commence too early in view of insuring good crops.

It is a common practice to plant them in some out-of-the-way corner of the garden, owing to the fact that young tubers persist in growing after once they have occupied any given space of ground. These can be readily uprooted, however; hence no sufficient justification remains for not giving them such good culture as they certainly deserve.

Care should be taken not to cut down the ripening stalks too early in the autumn. It is during the ripening process of these stems that the tubers attain to their full size, which they cannot do if deprived of them prematurely. The tubers should not, as a rule, be dug up and stored away, as is customary. By doing so they entirely lose that freshness which is so prominent a feature in all home-grown vegetables.

Plant the "sets" four inches deep, and slightly mould up the young growing plants when about six inches high.

Asparagus (*Asparagus officinalis*). French, *Asperge*; German, *Spargel*; Spanish, *Esparagos*.—It is to be regretted that asparagus is looked upon so much in the light of a luxury, and not of an ordinary vegetable. Wherever moderately good garden ground, with moderate exposure, exists, annual crops may be secured, with no more trouble than is usually needful in the case of all which are known or considered as ordinary vegetable crops. The fact is that when this plant was first placed under garden culture a system was originated, which has gained precedence, almost exclusively, to this date. To this idea must be attributed the belief that without costly prepared beds, and expensive attendance subsequently, no good results could be obtained. We give the older method first, and then a far simpler way of growing it.

On the old plan, one or more beds are requisite, each four and a half feet wide, with intervening alleys not less than two feet wide. According to the number of beds to be planted, so must the ground be marked out. The whole must first be trenched thirty inches deep or more, as the nature of the subsoil permits. During the process of trenching well-seasoned manure must be added to the bottom and centre, as well as a goodly dressing dug into the surface. This work should, if possible, be performed during the month of February or March.

The whole being trenched and manured, lay out the beds to the required size, with alleys between, elevating the beds at this stage slightly above the alleys. The proper time to plant seedling plants is when they are just commencing to grow, a process which varies with the seasons. Draw a line along the bed lengthwise, from end to end, nine inches from the side. With a rake or hoe form a drill for a row of young plant roots. Lay the plants therein, with their apices near to the line, from eight to nine inches apart, spreading the roots out straight from the centres; then cover over to a depth sufficient to

keep them in place. Plant other rows to complete the bed, a foot apart. When the bed is planted, place soil from the alleys over all to a depth of about three inches, raking the rough particles off, and watering, should the weather continue some time dry.

Keep the bed scrupulously clean and free from weeds during the summer. So soon as the growth made ripens, cut it down close to the ground, clean the surface, place a layer of well-rotted manure over it, and again cover all with about an inch and a half of soil from the alleys. This latter operation, perform any time from October to December inclusive.

About the last week in February it is advantageous to just loosen up the surface of the beds with a fork. At this time a slight dressing with salt may be given with advantage. It neutralises injury done to the young blades by insects, and eventually aids the roots materially. By this method beds last well for seven or eight years. In Austria they often prove prolific for twenty to twenty-five years on the same principle, with the addition of crushed bone, horn, &c., laid at the bottom of the bed.

The most economical, and what will become the most popular, method of growing asparagus, is far simpler. It is indeed well in most places, if possible, to prepare the ground by trenching, manure, &c., as above, though this is by no means necessary. Every possessor of garden ground may grow asparagus, even if it be only manured and prepared as for potatoes, and reap excellent crops, though not so good certainly as when the soil is manured and trenched more deeply as advised. And some deep sandy soils exist, such as those round Colchester and elsewhere, requiring only manurial aid to insure the best results. However, the soil being prepared, draw drills therein one inch in depth, and three feet apart, and sow the seeds during the month of April, watering them in, should the weather at that particular time be dry.

So soon as the plants are six inches high, thin them out, by removing all the lesser ones, &c., to nine inches apart. Keep well hoed during the summer, and give manure-water occasionally. Grown so for two summers, a moderate first cutting may be made the following spring; in view of which slightly prick over the surface soil between the plants to within an inch of the roots, place the soil in mound form over the crowns of the plants, then place a thick layer of good manure over the whole surface of the bed.

Cultivated in this way, the great annual labour of packing up the beds is dispensed with, besides which, rows of early Paris Cos lettuces can be annually produced by sowing the seeds between the rows of asparagus early in the month of March each year; or the amateur may simply grow one or more rows across any piece of good garden ground, giving merely annual manuring and attention, less than many vegetables require, and secure good produce.

Seedling asparagus plants have to be especially prepared where the system of transplanting is followed out, which may be done in connection with both methods referred to above. The better plan is to place a thickness of soil upon a hard level bed of cinder ashes, or similar material, the richer it is the better. Sow the seeds thinly in drill rows, about twelve inches between the drills. Thin the young plants out well when large enough, and encourage to make a good growth by copious manurial waterings. The following spring, push a spade or shovel along the surface of the hard bottom beneath the soil, and so raise the whole plant up; detach one plant from another in the most convenient way without injury to the roots of any, or tearing the soil from them, and plant as before advised.

Selected or improved varieties generally produce finer blades than ordinary seeded plants do, for which reason Conover's Colossal, an American variety, should have precedence, by all who would succeed thoroughly. It is important also to procure seeds from a reliable source. The general practice is to procure two-year-old plants from reputed nurserymen. By so doing, a year or more is saved in the ultimate production of a crop.

In instances where a bed already exists, and a future renewal of its contents is anticipated, seeds may be sown in advance to produce the needful young plants in due time. Where the better system of sowing in soil placed upon a level and hard basis is not followed, sow the seeds upon an open sunny bed, in rich soil, not too thickly, leaving them to complete therein a two-summers' growth. In taking them up at the stage already indicated, use great care not to break any roots. Every root so destroyed limits the immediate future growing capacity of the plant, besides a risk of injury to other parts owing to the decay of the same.

The asparagus is mostly a seaside plant, growing near sand-covered rocks even on some western coasts of Great Britain. It is a great aid to their superior culture to use abundance of sea-weed in the bottoms of the trenches, when preparing the ground for them; and the majority of inland soils would be made vastly more fitting for this plant were they very liberally mixed with sea-sand.

Many good and highly promising asparagus-beds are destroyed, owing to the thoughtless persistence of the possessors in cutting for use out of season. Not only does this practice so exhaust the root-base, that it has not power to make strong summer shoots; but such shoots as are permitted to grow are often

incapable of maturing, and placing such a store of strength to the root's account below ground, as alone can enable them to produce freely and well in the following spring. During both the first and second years following the planting, the young shoots must be permitted to grow freely; none must be cut. To do so destroys the future quality and prolificacy. English growers err generally in commencing, and continue to cut till too late in the season, young immatured plantations. Such a tax is never thoroughly overcome.

Forced asparagus is very easily obtained, where three or four-year-old plants exist along with sufficient fermenting materials to form a bed with, and frames with sashes to place over them. Asparagus plants are not fit for forcing under three years' growth, though they cannot be too old for the process. A bed should be made up whereon to force, similar to such as are prepared for cucumber growing, in connection with which it is known such a height and thickness is necessary as will retain heat within it—aided in severe weather by periodically placed linings—for some time.

When the heat at the centre of this bed does not exceed 100° Fahrenheit, a layer of decomposed manure or soil is first laid upon it, it is trodden somewhat firmly down, and the plants, taken up with soil adhering between the roots, are packed thereon as closely as possible together; one lot of roots overlying another in such a manner that as many as practicable are pressed in; all having the crowns, with young buds, as nearly as possible level. As giving some idea what any given size frame will hold, it may be said that 400 three-year-old plants can be placed in a two-light.

When as many as possible have been neatly packed within the frame, place just sufficient rich, light soil over all to cover the crowns, insert a test-stick to study the heat by, leaving the lights off until it is known that the heat does not fluctuate unduly, and a mean temperature of about 90° exists. Immediately a slight downward tendency is observed in this internal heat of the bed, add about three inches more soil, consisting greatly of leaf-mould and sand, giving a good watering with tepid water —sufficient, in fact, to moisten the roots below thoroughly; place the lights upon the frames, and shut them down close. With heat maintained within the bed as near to 85° as possible, give no air until the young blades push through the soil freely. A little fresh air admitted by tilting with a wedge at the back just for half an hour daily to improve the flavour will be ample. Should the internal heat of the bed fall, resuscitate it by adding a lining first to one half, and again, in about eight days' time, to the other half; and as the cropping continues give other waterings as needful, a little manure-water being very advantageous ultimately, and when the old roots have formed their minor feeding rootlets.

Forcing in mid-winter is far more laborious than during the early spring, or February, every care being necessary to deter cold air from blowing from without between the frame and the bed. During very severe weather the sides of the frame without must be well covered up, too, with thick linings and with hay or straw, as well as mat coverings placed over the glass. Very slight warmth arises through these thicknesses of roots and soil, so that severe frosts readily gain ingress if not well guarded and provided against. Forcing asparagus within glass-houses, having needful beds and heating media, has to be performed on precisely similar bases. In this latter instance very much more water should be applied to the roots; surface syringings or sprinklings being also frequently necessary to counteract the drying tendency of the pipes within.

Whenever forcing is undertaken, it should be done rapidly and well; to revert to a cool or slower process after part of the crop is secured, lessens the ultimate yield and gives tough and inferior produce.

The following are the varieties in cultivation:— Argenteuil Early Purple, Argenteuil Late Purple, Connover's Colossal, and Giant Battersea.

Beans, "Broad" (*Vicia Faba*). French, *Fève de Marais;* German, *Bohn;* Italian, *Fava.* The Garden Bean, known commonly as Broad Bean, is an annual plant, and one of the very oldest associated with our gardens, introduced probably by the Romans, and a native originally of Egypt.

It is divided into three varieties or forms, viz.— the dwarf and small, or Mazagan; the Long-pod, containing somewhat elongated seeds; and the true short or blunt-podded variety, containing but two or three seeds, very large in size, and very broad.

The culture of the plant is of the simplest. It prefers a deep, stiff soil, only moderately manured, and such as has been dug up two or three months before seed-sowing. The three varieties named, especially in their improved modern forms, are all valuable from the fact that they aid cultivators in securing early, mid-season, and late produce, which without them would not be equally easy of attainment. The dwarf Mazagan is the hardiest, succeeded by the Long-pod, and finally by the old "Broad" variety; these characteristics being so marked as to secure such succession even when, in the early spring months, all are sown at the same date.

The seed-sowing rarely receives such an amount of consideration as it deserves. It is an error to make holes, toss the seed carelessly therein, and cover them over indifferently. A blunt dibble should

be used, such as will make a bed whereon the bean will fall, and can be made quite firm by superficial pressure of the side soil upon it. The common practice invariably permits hollows to remain beneath or beside them, much to their injury during and after germination. Another simple plan is to draw drills six inches wide and four deep, placing therein two rows of seeds, each seed being placed at angles with those in the opposite row. Unless the soil after it is drawn over these be trodden down firmly, the plant does not succeed so well as those resulting from dibbled-out seeds. The Broad Bean can be both conveniently and successfully transplanted; often a useful method to employ when it is desirable that it should follow a recent crop, but one the possible practice of which does not occur to many.

As to time of sowing, when a long succession is desirable, the Mazagan might be sown late in October and November, also about the middle of December, for the earliest crops. Sow to succeed the above early Long-pod during December or January, and an equal quantity of Taylor's Windsor, or Broad. Again plant of the latter in May or June, and, if desirable, another of the Mazagan during June and July, to give a crop before the frosts of autumn. The dwarf kind, sow one and a half to two feet apart in the rows; the taller ones, two and a half to three feet between. The seeds should be about two inches apart in the rows.

Fig. 1.—Slice lengthwise through the Flower of a Wild Rose, showing the vase-shaped receptacle (hip) enclosing the carpels, each with its style and stigma, and bearing at its upper edge the sepals (of which only a portion of one is shown), the petals, and the stamens.

All after-culture is of the simplest; when the young plants are about three inches high, well hoe between the rows to destroy weeds, then draw the soil in a ridge up to each row of plants from an equal distance on both sides. Beyond subsequent hoeings nothing more is wanted. To hurry on the crop and increase the size of the beans, pinch off the points of all, when all the flowers having expanded also begin to fade. It is important to gather the crop when the beans are little more than half grown; when approaching to maturity in size they lose flavour and are not appreciated. The Broad Bean is very subject to attacks of black Aphis. Root-waterings, removing the tops, and syringing with a strong insecticide, are means to its removal or destruction.

The best varieties are—Early Mazagan, Leviathan (*Aquadulce*), Seville Long-pod, Taylor's Windsor, Green Windsor.

THE ROSE AND ITS CULTURE.

INTRODUCTION.—THE BOTANICAL CHARACTERISTICS OF THE ROSE.

By Dr. Maxwell T. Masters, F.R.S.

IT would obviously be out of place to enter on full details under this heading, as many points it would be necessary to allude to would have little or no practical bearing. We shall therefore confine ourselves to a few leading characteristics to which it is desirable that the attention of the cultivator should be drawn. The genus *Rosa* of the botanists is one of those groups which it is easy to define, and which a tyro finds no difficulty in recognising. The case is quite otherwise with the species which make up that genus. Precision now gives way to vagueness and uncertainty, and the alleged points of distinction break down almost at the first trial. Lindley, one of whose earliest and best monographs was one devoted to this genus, was just in his remark, which reads now as if made yesterday (it was written in 1820):—"There are no limits to the species; it is impossible to give them rigorous definitions." If this be true of the wild forms as we find them in nature, what shall we say of those which have been designedly or unconsciously modified, for untold centuries it may be, by the hand of man?

Distinctive Marks of the Genus Rosa.—The genus *Rosa* is mainly distinguished from other plants, not only of its own order (*Rosaceæ*), but of all others, by its peculiar fruit. This is what is called familiarly the "hip," and its structure demands a little attention. By tracing the flower-stalk from below upwards, or better, making a slice lengthwise through the hip (Fig. 1), it is seen that the flower-stalk itself gradually dilates, and becomes fleshy, and ultimately brightly coloured. The "receptacle," as this part of the flower is botanically called, forms, in fact, a sort of cup or vase, in which may be seen a number of small, hard, dry nuts, each with a long thread at the top. These are generally taken by beginners to be the seeds, but are strictly not the seeds, but the carpels or seed-vessels, each containing a solitary seed; the long thread is the style, at the end of which is a button-like dilatation which is the

stigma. The hip, then, of the Rose consists of a vase-like swelling of the top of the flower-stalk, bearing the sepals, petals, and stamens from a rim just within the edge of the vase, and bearing the true seed-vessels, or "carpels," at the bottom. The nearest approach to this peculiar fruit is in the *Pomaceæ* (including the apple and pear), where we have pretty much the same structure, but with this difference: that whereas in the Rose the carpels are free from the vase within which they are included, in the *Pomaceæ* they are embedded within its fleshy substance, and form the "core" of the apple or pear (Fig. 2). If we add to the peculiarity of fruit just mentioned the circumstance that the species of *Rosa* are all of them shrubs with compound foliage—that is, (with one exception) the individual leaves are not in one piece, but each leaf branches into separate leaflets (Fig. 3)—we have said enough to enable any one to recognise a Rose, and to distinguish it from any other genus yet known. Our forefathers attempted to define a Rose according to the flower, as superficial observers would do even now; but by so doing they jumbled up together all sorts of things, many having no more real relationship one to the other than a cabbage to a cocoa-palm. The real marks of distinction are those here stated.

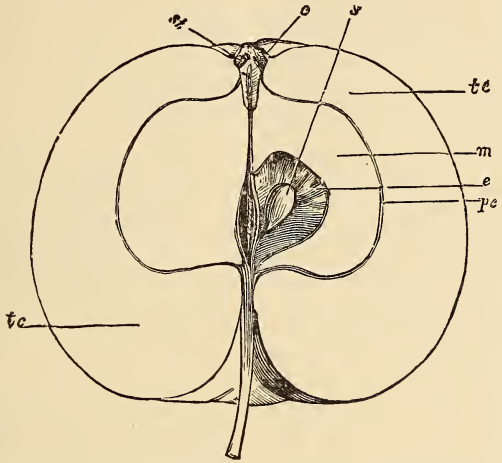


Fig. 2.—Slice lengthwise through an Apple, showing the globular fleshy receptacle (pome) in which the carpels are embedded. At *c* and at *st* are the withered remnants of the calyx and of the stamens respectively; *tc* shows the fleshy part of the receptacle; *p* is the rind of the receptacle; *m*, the fleshy portion; *e*, the core or true seed-vessel; *s*, the seed.

Fig. 3.—Compound (pinnate) Leaf of a Rose, showing two pairs and one terminal leaflet. *st* are the leaf-scales or stipules springing from the sides of the petiole or leaf-stalk.

Having now endeavoured to convey an accurate notion as to what constitutes a Rose in a botanical sense, we may next call attention to some of the more important characteristics of the species, referring the reader for fuller details to strictly botanical works.

The Root.—The root of a Rose in its early stages, soon after its emission from the seed, is a tap-root, *i.e.*, one having the form of a long cone, with a stoutish trunk descending relatively to a considerable depth, and giving off numerous branches at a somewhat obtuse angle. The root is thus so organised as to secure firm attachment to the soil, and a supply of nutriment at various depths. The root of a Rose (we are speaking more particularly of wild ones) is well equipped for taking part in the competition with other vegetable forms. As the plant grows, the base of the stem and the upper part of the root become more and more woody, and ultimately form a thick "root-stock," which does not itself absorb food, but which serves as a store-place for the food, which is derived partly from matters taken up by the root-hairs and finest root-fibrils, partly by the aid of gases absorbed from the atmosphere by the leaves. By this conjoint agency of leaves and root nutritive matter is formed, and those portions of it which are not used up by the growing plant are stored in the reservoir afforded by the younger and outer portions of the woody stems, and more particularly in the root-stock. There they remain till requisitioned in spring to supply the needs of the growing parts. The thick butt-end of a Rose-stock, as taken from the hedge-row for purposes of "budding," has hence a degree of utility beyond what is often recognised.

The Stem and Branches.—The modifications of the stem and its branches contribute especially to the "habit" of Roses. The branches may be erect

and stiff, or trailing, or arching, or scandent. When they take the form of "suckers," which are branches proceeding from the underground stock, they are not regarded with favour by gardeners. Most often the Rose-shoots are covered more or less with woody prickles of variable size and appearance. These enable the Rose, in a wild state, to push its way between other competing shrubs, and to support its branches and expose its leaves to light and air at the expense of its neighbours, and with a proportionately small expenditure of force or tissue on its own part. The prickles are often curved, with the points downward. In this way fewer obstacles are offered to their upward passage among competing branches, while the hooked form insures a firmer hold, and prevents the branches being dislodged. The form and arrangement of the prickles furnish most valuable means to the cultivator for the discrimination between different varieties when other marks of distinction are not available. These prickles are superficial outgrowths from the rind, not to be confounded with spines, such as one sees on the hawthorn (*Cratægus*), which are true branches, though in an abortive condition. Other superficial outgrowths from the skin of the stem or the leaves are glandular hairs of various kinds, which contribute to the perfume of the plant, as in the Sweet-briar, and serve as a means of discrimination between different varieties.

The Leaves.—The manifold variations in the appearance of the leaves scarcely need more than the mere mention. An idea of their extreme variability may be gained by comparing the simple leaves of *R. berberifolia*, the glossy leaves of the Macartney Rose (*R. bracteata*), the rough leaves of the Japanese Rose (*R. rugosa*), with the leaves of the Sweet-briar, or of the common Moss-rose. Size, form, colour, nature of the pubescence of the leaf as a whole, form and degree of toothing of its margins, are all points to which the attention of the Rose-grower must be drawn.

Inflorescence.—By "inflorescence" botanists mean the arrangement or grouping of the flowers on the stem or branches, and in the case of the Rose this is of great importance from a cultivator's point of view. First of all, there is the fact that the branch or branches which immediately support the flower are always "terminal." That is, they are at the end of the shoot, and are not developed from the sides, in the axils of the leaves, nor from thickened spurs, as in pears or apples. Then the flower-buds of the nascent inflorescence are always formed on the wood of the year. In the apple, or pear, or peach, the flower-buds are formed in the summer or autumn of the year preceding that in which they are to unfold; but in the Rose, the flower-buds are formed in the same season as that in which they expand, and, as we have said, at the ends of the branches — points which the pruner needs to heed. The cultivator, too, will note that the work which a Rose has to do must be done very rapidly; and, moreover, that it is done more or less continuously till stopped by the advent of frost in autumn. The necessity for shelter, an adequate food-supply, and an ample quantity of water during the growing season to obviate any check to growth as far as possible, is thus rendered obvious.

The distinction between those Roses whose flowers are borne singly, and those which are in trusses or clusters, is obviously a matter of great practical moment, but botanically the difference is slight, being only one of degree. The inflorescence of Roses, in fact, comes under the category of "definite" inflorescences, so called because the flower defines, or puts a stop to the extension of the stem in that particular direction, any subsequent growth starting from below the first and, of course, at an angle with it. Thus, if in a truss there are three flowers—a common case—then the central one is the oldest and first-formed, and the side ones are formed subsequently, belonging, as botanists say, to a different "generation."

When there is but one flower, that arises from the fact that the side ones are not developed, but the spot from which they should spring is generally indicated by a joint, or sometimes by a leafy scale. By suppressing or pinching the side-buds the grower often has it in his power to bring about increased size and colour of the flower, while by suppressing the terminal bud he can, as it were, postpone and prolong the blooming season. What are called Perpetual Roses (*Roses remontants* of the French) are Roses in which new inflorescences are produced in succession throughout the season; and a minor degree of the same phenomenon is brought about by the difference in the time of expansion of the first or terminal flower-buds as contrasted with the lateral ones.

The Parts of the Flower.—The calyx of the Rose consists always of five sepals, varying greatly in appearance in different cases, but always springing from the top of the hip in which the seed-vessels are concealed. The five sepals are not formed all at the same time, but in succession, and this sequence remains obvious even in the fully-developed flower-bud, by the manner in which the sepals overlap one another, and often by their appearance. Thus there are two placed outside, two within the bud, and one half in, half out. The appearance of the sepals in these cases

often varies; thus the two outer ones have little leaflets on each side, the two inner ones have none on either margin, while the intermediate one has miniature leaflets on one edge and none on the other.

The normal number of petals is five, as may be seen in the lovely briar-roses of our hedges; but under cultivation the number becomes vastly increased by the substitution, more or less completely, of petals for stamens. The general form of the Rose flower—"globular," "cupped," &c.—depends upon the form of the hip, and on the number, arrangement, and size

Fig. 4. —Flower of a Wild Rose seen from above, showing a portion of the stalk, the tips of the sepals, the five petals, the numerous stamens, and the stigmas filling up the centre.

of the petals. The concavity of some petals, the rolling back of the margins of others, are peculiarities dependent on the varying rate of growth at one part as contrasted with that at another. If, for instance, the rate of growth be greater at the margins than in the centre, the petal will necessarily be concave; if the upper surface grow faster than the lower, the latter acts as a curb, and the tip of the petal will be rolled back. The exquisite colours of the Rose, varying from pure white to various shades of yellow, and from pale pink to rich crimson, depend, as in other flowers, partly on coloured juices within the petal, and partly on a series of minute pimple-like projections from the surface, visible under a low power of the microscope, and which break up the light and give that velvety translucence to the flower which constitutes one of its main charms.

The stamens, under normal conditions, spring from the inner edge of the hip within the sepals and petals, as shown in the section at Fig. 1; each consists of a slender filament, capped by a small anther containing the pollen which is required to fertilise the germ in the young seed-vessel, and which germ so fertilised becomes the embryo or seedling plant. The stamens are extremely numerous, and apparently arranged without order, but in the very early stage of development it is easy to see that there are only five, and that all the rest are mere subdivisions and secondary formations from the five primitive ones. Even in the fully-developed flower, the original five-fold division may be traced in the quartered flowers of such Roses as *Souvenir de la Malmaison*. In garden Roses the stamens are, as above stated, more or less replaced by petals, although never completely so, or the flower would be sterile.

As to the nature of the seed-vessel and fruit, that has been sufficiently dwelt upon for our purpose already.

How to Obtain New Roses.—All that it is necessary to say in this place is, that any one who wishes to cross Roses, with a view of getting new varieties, must apply the pollen from one flower to the stigma of another, taking care that the latter is not fertilised by its own pollen. This essential is secured by the removal of the stamens from the unopened bud of the flower it is intended to cross. The principles involved in crossing are simple, but the practice requires much patient care, intelligence, and forethought: qualities whose exercise will probably be repaid by accessions of variety and beauty, which will surprise and delight those who complain, and not without reason, of the number of "too-much-alike" Roses. A word may be said here as to the other methods of obtaining new Roses. The most common way is simply to sow the seeds. Among the progeny are sure to be some sufficiently different from the parent to attract attention, and probably to be worth propagating. Of course, it is advisable to sow seeds from the best kinds and the healthiest plants. Another method is by removing and propagating chance bud-variations or "sports." A white Moss-rose, for instance, may suddenly be produced on a branch bearing flowers of the ordinary character, and if this "sport" be removed and propagated, it may be perpetuated. The origin of these "sports" is mysterious, but it is generally supposed to be due to the dissociation of previously-blended characters. Roses, like all other long-cultivated plants, have a very mixed ancestry; and sometimes, for reasons we cannot explain, the characters of some of the ancestors suddenly become, as it were, disentangled, and show themselves in their original unmixed state.

Native Country of the Rose.—The species inhabit the temperate regions of the Northern Hemisphere, not growing wild within the tropics, but, on the other hand, extending far north and to sub-alpine elevations. European, Asiatic, and North American Roses have each a distinct appearance, and their numbers no one can compute, as it is so entirely a matter of individual opinion whether they shall be reckoned in tens, or whether we shall take the pains to verify the alleged distinctions between hundreds.

For our present purpose, it will suffice to speak of a few of the most generally admitted species according to their geographical origin.

Among European Roses we may allude, in the first place, to certain species which occur wild in our own islands.

R. spinosissima is a low-growing form, growing in waste places often near the sea, and distinguished by its small neat glandless foliage, its crowded stiff prickles and its globular blackish fruit. This is the parent of the Scotch Roses of the garden, the flowers being usually small, globular, and delightfully fragrant. Its creeping underground stems and suckers render it useful in fixing light soil by the sea.

R. rubiginosa is the origin of the Sweetbriar, whose fragrant foliage is alone sufficient to distinguish it.

R. canina is the common Dog-rose of the hedges, very variable in foliage and flower. Its prickles are strongly hooked, and its foliage usually without glands.

R. arvensis has more of a trailing habit than the preceding, and differs more especially in the styles, which in this species protrude from the mouth of the flower-tube, and, instead of being free, are more or less united together. It is the parent of the Ayrshire, Dundee Rambler, and other robust-growing climbing Roses well adapted for pillars or trellises, or as weeping trees.

R. moschata is a native of Sicily and of the Pyrenees, extending also into Northern Africa. It is a form rarely seen, having few spines, leaflets glaucous beneath, flowers white, with a perfume of musk, and arranged in clusters. The Noisette Roses are said to have originated from the cross-fertilisation of this species with the Chinese Rose.

Fig. 5.—Branch of *Rosa Gallica*, showing prickly stem, stipules, pinnate leaves, definite inflorescence, flower-buds, and expanded corolla, as described in the text.

R. sempervirens is a native of Southern Europe, of the same climbing habit as the *R. arvensis*, but with nearly evergreen leaves. *Félicité perpetuelle* is one of the best known of its descendants.

R. Gallica is a native of Central and Southern Europe, and is abundant in Austria and Switzerland. It is a shrub with weak prickles of uniform shape, rigid glandless leaves, and erect flowers. From it, or from crosses with it and others of the Centifolia, Chinese, Noisette, and Bourbon Roses, has arisen a vast variety of garden Roses of all colours, and of every variety of habit (Fig. 5).

R. cinnamomea is a species native of North and Central Europe, forming a greyish shrub with cinnamon-coloured branches, beset with few spines, very large stipules, and long pointed sepals, the petals being of a pink colour.

R. Alpina, a native of the mountains of Central Europe, forming a shrub without spines, with pale pink erect flowers, elongated pendulous fruit on a hispid peduncle.

Amongst Asiatic Roses we may first note a few which are natives of Asia Minor.

R. eglanteria (*lutea*), often considered, but erroneously, to be a native of Southern Europe. It forms an erect bush, with very irregular prickles; doubly-serrated leaflets; flowers usually solitary, of some shade of yellow. From this have originated the Austrian Briars and Persian Yellow of the garden. The species is a native of Asia Minor, of the Himalayas, Afghanistan, and Siberia.

R. centifolia is a native of the Caucasus and of Asia Minor. It forms a shrub, with unequal prickles, flowers nodding, white or pink. This is the parent of the Provence or Cabbage Roses, of the Pompones and Moss Roses, the latter so called from the profusion

of glandular moss-like scales or hairs with which their stalks and sepals are covered. It is very like *R. Gallica*, but has less tendency to produce suckers; the prickles are more unequal, and the leaves more flaccid. This is the Rose from which the attar is chiefly made. Crossed and re-crossed with varieties of *R. Damascena* and *R. Indica*, this has given rise to the group known as Hybrid Perpetuals—the most popular of all Garden Roses.

R. Damascena is a form of unknown origin, usually considered to be derived from Syria, and perhaps only a form of the preceding. It is characterised by robust habit, stout unequal prickles, leathery green leaves, and reflected calyx-lobes.

R. Ecæ is a newly-described Rose from Afghanistan, remarkable for its dwarf habit, dense prickles, and small yellow flowers. This species, with some others, is used for forming hedges in Afghanistan.

R. sulphurea is another yellow-flowered rose, with leaflets whitish beneath. It is a native of Asia Minor and Persia.

R. alba has grey rugose leaves and large white flowers. It is a native of the Caucasus, and perhaps of Afghanistan.

R. involucrata, the *R. Lyellii* of Lindley, is the only species of Tropical India, where it forms the Common Rose of the Bengal plains.

From China comes the very distinct Macartney Rose, *R. bractcata*, the foliage of which is sub-evergreen, and deep shining green in colour; the flower-stalks have large bracts, as the leaf-like organs or scales on the flower-stalk are called, and the cup-like flowers are porcelain-white, and very beautiful.

R. microphylla is a Chinese species, remarkable for its small and numerous leaflets. It resembles the Macartney Rose, but has the hip studded with bristles, so that the flower-buds are "as rough as a hedgehog." (W. Paul.)

R. Indica is another Chinese species, with evergreen glabrous leaves, glaucous stems, reflexed sepals, and pink flowers. It is the parent of the Monthly, or China Roses, as also of the Bengals, Bourbons, and Teas, and possibly of the Noisettes. The Fairy Roses are referable to this type, as is also the Manetti, used as a stock.

R. Banksiæ is a climbing form with glabrous evergreen leaves, few or no prickles, and tufts of small double yellow or white flowers of great beauty.

R. Fortunei is also a climber, with glabrous leaves, small hooked prickles, large solitary white or yellow flowers.

Among Japanese Roses may be mentioned *R. multiflora*, a climbing species, with deeply-divided stipules and bracts, flowers small in clusters, flower-stalks hairy. There are several varieties, of which *R. polyantha* is one, and *Rose de la Grifferaie*, used as a stock for budding, is another.

R. rugosa is a very remarkable bush, being densely prickly, with very dark green bullate foliage, and large pink or white flowers two inches or more across, succeeded by large globose red fruit. It is one of the most distinct of the species.

The Roses of the United States are not numerous, and they have not given rise to many garden forms.

R. setigera is the only American climbing form. It has stout straight prickles, and trusses of pink flowers.

R. Carolina is a species found in cottage gardens, forming a tall bush with stout prickles, leaves greyish beneath; flowers in clusters, pink.

R. lucida is lower-growing than the preceding, with very numerous bristles, and a few straight prickles; leaves shining above; flowers in clusters, pink.

SUBURBAN GARDENING.

By James Hudson.

SUBURBAN DIFFICULTIES. PREPARATION. PLANS FOR SEMI-DETACHED VILLAS.

SUBURBAN gardens differ widely in many respects from those situated in the pure air of the country. Only those practically acquainted with the many difficulties and obstacles in the way of successful cultivation can fully realise these drawbacks, and endeavour by experience gained in past failures to attain to future successes. This is applicable in some degree to every branch of horticulture, but more especially as regards the cultivation of fruits, plants, trees, and shrubs; vegetables, from our experience of the past fourteen years, being the least susceptible to the unpropitious influences of fogs, blacks, and smoke. These unavoidable deterrents to vegetation in general have to be overcome in the best way possible, and success in this direction is brought about by a selection of such material in each department of gardening as is best calculated to withstand these counteracting influences.

Those who live in the pure country air have no conception of the many difficulties that must be contended with to preserve even a tolerable state of cultivation when surrounded by or adjacent to populous neighbourhoods; and this condition of affairs is still worse when in the vicinity of manufacturing towns or cities, or in the case of London, for example, where the suburban districts are now thickly populated in nearly every available instance. This adds to the accumulation of deleterious gases that are given off by the metropolis proper, many of which are slow poison, at the least, to plant-life in general.

Limitation of Choice.—The owners of small gardens under such conditions must not, therefore, compare products with their more fortunate friends who reside in the country. There, many garden favourites can be grown with the greatest ease, which in large towns cannot, with the utmost attention, be induced to assume even a medium appearance. Notably is this observable with that universally admired flower, the violet, which many experienced cultivators fail to produce in town in a satisfactory manner. Other plants also linger out a forlorn existence, their very appearance making one feel miserable in the extreme, since after all the care and attention that has been bestowed on their culture the record is but one repeated failure. Not only is this the case with plants that are grown in the open air, but the inmates of glass-houses are also susceptible to the same vitiated condition of the atmosphere, especially during the prevalence of fogs.

With all these counteracting influences at work, considerable discretion should be exercised in the selection of occupants of the suburban garden; for it does not follow, by any means, even with these drawbacks, that the garden cannot be made enjoyable. Many instances may be noticed by those who really take an interest in successful gardening operations, wherein (by the employment of suitable subjects) suburban and town gardens may be and have been made to look well. One exception must, however, be taken into consideration, and that is the deposit of "blacks," which in some places, in some directions of the wind, it is *impossible* by any means to avert. Suburban gardens suffer in this respect as well as town plots; and it is perfectly astonishing what an amount of blacks, soot, and other deposits are left behind after one of the spells of dull foggy weather. We imagine this to be caused by the heavy, dense state of the atmosphere, which causes these deposits to be precipitated on all surroundings instead of being carried up higher, and thence more widely disseminated, as is the case when the atmosphere is more light and buoyant. A heavy downpour of rain is a great boon to town gardens after a prevalence of such weather.

Those who have any glass-houses will also need to pay attention to the cleansing of all the glass occasionally, according to the condition of the weather. Even a little way out of town, we find this imperative during the dull season of the year, bearing in mind that the maximum of light is essential at such times for the proper development of plant-life. This is best accomplished by taking a hair-broom, and carefully passing it up and down each pane of glass a few times; this will generally have the effect of loosening the deposit, which is then easily washed off with a syringe or garden engine. A small-sized form of this latter most useful garden implement would soon repay its cost in more ways than one. The shrubs can be washed with it as well as the glass, and roses and other flowers would be refreshed by its application after a hot and sultry day. The windows, too (though outside of the gardening sphere), could be cleansed with the same useful implement.

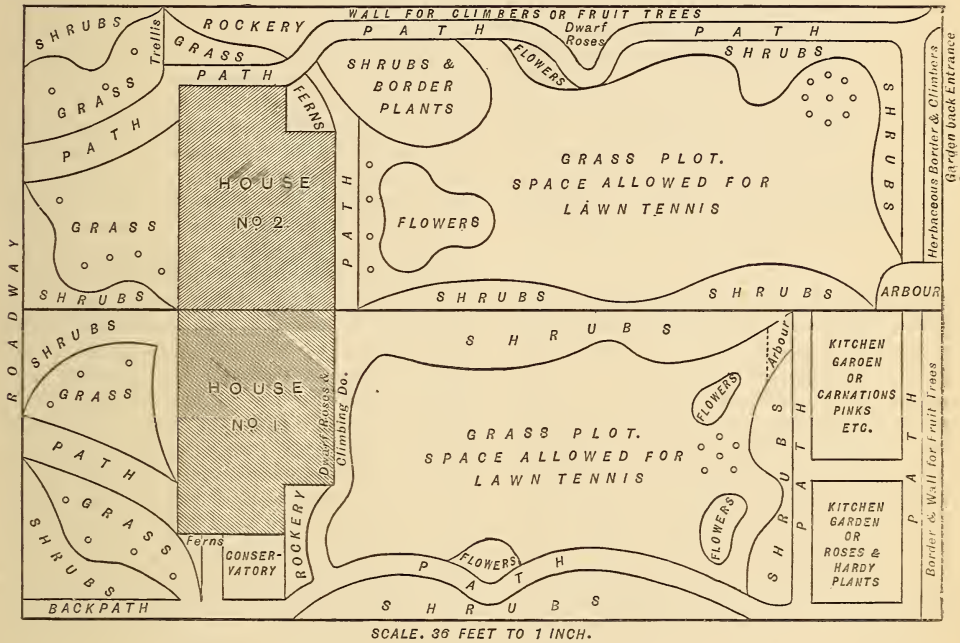
Town and suburban gardens are necessarily in most cases of very limited extent; it is hardly possible for them to be otherwise, having regard to the greatly enhanced price of land in close proximity to our large towns and cities. Where by chance garden space is of more than average size, the increased rental is oftentimes a hindrance, causing the would-be tenants to prefer the quieter repose of the country now that the means of locomotion are so much more expeditious. We have observed of late that agents having the disposal of eligible building sites near our thickly-populated centres of activity, have been impressed (not too soon) with the growing necessity of allowing more open space around the buildings they have in contemplation. One common error is that of pushing up the frontage too close to the building line of the road, thus allowing of no fair amount of space whereby to render the front or entrance side of the house of a pleasing or attractive character. A well-kept and tastefully laid-out design in the front of the house, is the admiration not only of all visitors but of all passers-by.

At the best, however, the space is but limited, and the utmost amount of ingenuity must be brought into play to economise the said space to the best advantage. The same remarks apply with equal force to the back or garden side of the house, which is invariably a long narrow strip of ground having walls running parallel with each other. By some contrivance, however, variety can be given even to such strips as these, as we hope to show in the accompanying two designs, which are distinct from one another, although the house and the ground are supposed to be alike in each instance. We shall in the present article describe each of these suggestions for the laying out of gardens in connection with semi-detached houses; in a subsequent article treating of gardens connected with terraces or rows of houses, where many dwellings are built side by side: after which we purpose to give a plan of a detached villa, standing surrounded by its own grounds; beyond that scale, all that is necessary may be gathered from other sections of this work.

The Soil on Building Ground.—With regard to all land that is being devoted to building opera-

tions, it is necessary to make a few brief remarks at the commencement. Builders of suburban houses more often than not make a most fatal error in the beginning of their work, by the manner in which they treat the ground where building operations are being carried on. One may often see the announcement, "Turf and loam for sale." Now this ought never to be allowed by the ground landlord in the first instance, if he values the future appearance of surrounding ground as will be trafficked upon during building operations. This would of course entail a trifling additional outlay, but that would be amply compensated for in the laying out of the future grounds for planting with shrubs and flowers, and for laying down in grass.

Sufficient soil, too, would thus be obtainable for mounds and undulations, which are hardly ever thought of by those who arrange this description of



SCALE. 36 FEET TO 1 INCH.

PLANS FOR GARDENS OF TWO SIMILAR SEMI-DETACHED VILLAS.

his estate. It is robbing the intended garden surroundings to a considerable extent. Dispose of the subsoil, if you like, from the excavations for foundations; but *never* that which should nourish the future shrubs and flowers. Instead of this being the case, the subsoil is too often retained as being quite good enough for the garden. Many a failure with the latter may be set down to this cause alone, which to inexperienced eyes would not be explicable on the surface of things as observed at the time of failure. What ought to be done is as follows:—Previous to any cartage being permitted on the ground, the turf and top spit of soil should be shifted from the space to be occupied by the buildings, to a convenient distance for future use, including as much of the garden. These must, however, be made in such a manner as to receive the due amount of rainfall necessary for plant-life. We have often seen that where this kind of work has been attempted, even in larger gardens, it has not had proper consideration in this respect; these mounds and undulating surfaces being finished off at too sharp an angle, thus causing the water to run away into the hollows. All variations in the surface arrangement of the ground should be done in a gradual and easy manner; the proper amount of rainfall will then be more likely to be absorbed for the benefit of the shrubs. We have seen these latter suffering miserably when planted on a sharp sloping bank, and requiring an unnecessary amount of attention in manual watering.

which, with foresight, might have been avoided with comparative ease.

When the precaution of removing and storing the best soil for the future garden has been omitted, the neglect will cause the same to be almost unmanageable for years to come, since the roots of all the plants placed therein will have a hard struggle to lay hold of the soil left for them. The end of this will be that some quantity of manure will be recommended as necessary for improving the condition of the ground; which, with careful management, in the majority of cases, is not requisite for some few years at the least, when sound virgin soil has to be dealt with. Plenty of such will frequently be found in suburban estates, that are taken up for building operations. It is true some little modification of the soil may be necessary for special things. Thus, Roses and Rhododendrons may require the addition of well-decomposed manure, or a little peat for the latter when the soil is somewhat tenacious; but as a whole the ground will be nourishing and good.

Preparation of Suburban Gardens.—Such gardens as we have now under consideration are also frequently prepared in but a superficial manner. As long as they present a good appearance to the inexperienced observer, and to those who are unacquainted with the *modus operandi* of "facing up" for the time being, it is thought sufficient, regardless of the future well-doing of the occupants of the garden. The ground should be moved about two spits, *i.e.*, two depths of a spade, retaining the surface soil at the top when it is found to be of better quality than that underneath. This would be commonly designated "trenching," in gardening phraseology, and will be dealt with elsewhere. Previous to this being done, however, the necessity of drains will have to be considered, and these ought to be laid down to suit each given case. Those that are required for the paths will not need to be laid much below the surface, being then more accessible in the event of any stoppage. For draining the other portion of the grounds, the depth should be about two feet six inches, if in a heavy clay subsoil, the draining of such soil being oftentimes frustrated, by reason of the very depth at which the drains are laid; for if at three or four feet depth, they will, in time, become useless, the water not percolating this adhesive soil with any freedom, but rather remaining near the surface. On the other hand, drains at the latter depths will be better on lighter land. For these purposes drain-pipes of at least three inches diameter should be chosen, and without socket ends, so that the water can the more readily enter them. The lowest point of the grounds should be fixed upon for building a tank capable of holding a good quantity of the ground-water, for use in the garden as occasion may require. There is no reason why provision should not thus be made to secure this indispensable aid, and the more so, taking into consideration the high rate at present charged by the water companies for any supply through them. By arranging the tank in one corner of the garden, and fixing a pump over the same, there will not be any eyesore or inconvenience in any way; but the precaution must be taken of arranging for an overflow, so that the inlet drains never have any water standing in them.

After the drainage and trenching operations have been finished, that portion of soil removed from the ground taken for the house, as previously advised, can be utilised, as we suggested, to break up the even surface of the ground into mounds and undulations, which will have a much prettier effect when completed. For convenience, also, the paths should be fixed upon in as early a stage as possible of the work. The soil for at least ten inches in depth can be taken out of this allotted space also, and used as we have just advised for that taken from house-space. This will add considerably to that quantity, and be found of much service. There will generally be sufficient rough material available from refuse left by the builders for the formation of the paths; brickbats and such-like things making a very good foundation, to be finished off, when all the ground work and planting has been done, with a good coating of gravel, which will then run in no danger of being mixed up with the soil. This also will be fully dealt with elsewhere. Any moving operations with wheelbarrows can be done on these paths before they are completed; this will help to bind them down in a solid manner. Planks should be used to move any soil across that part of the ground that has been dug over. The portion of space devoted to shrubs and borders should be staked out, to give a rough idea of the plan to be worked upon. This should then be dug or forked over, if any of it has been trodden upon so as to cause it to become heavy and close.

The planting operations can then be commenced, fixing on the spots for the most prominent shrubs and plants with due regard to their style of growth, and what they are likely to be in appearance in a few years' time. The smaller shrubs can then be planted, and, as this work proceeds, the ground should be lightly forked over. The staking of tall plants that are likely to be blown aside by the wind should be seen to, and, in doing this, a little wad of straw, if tied around the stem, will preserve it from injury by friction with the stakes. We would advise that all newly-planted shrubs be watered at

planting-time, unless the ground is excessively wet; the work, however, ought to be deferred when the ground is in that state. In the course of a week or two after planting, the shrubs will require to be gone round again, and trodden somewhat firmly just about the stem. This is better done when the ground is in a dry state. A medium course as to the *quantity* of shrubs planted, will be the safest plan to follow. If excessively crowded, the growths will be drawn up weakly, and the soil more readily impoverished. If planted thinly, there will be bare spaces between each plant, which will not look well. By following a middle course, some of the shrubs in the course of a season or two can be removed where thickest, and re-planted where any may have failed to succeed in a satisfactory manner. This re-arranging is advisable every season or two for the first few years, till every part of the garden is well regulated. This will also be found a better plan than buying in fresh plants to fill up vacancies, as long as it can be worked upon.

After the planting operations are completed, the space devoted to the lawn will require attention. If it is not pressing to have a green surface at once, the better plan will be to prepare the ground for sowing with select lawn grass-*seeds*, which can be obtained of any seedsman with experience in such matters. The lawn-space will in this case require to be trodden over somewhat firmly and evenly, then raked down to an even surface, after which the grass-seed may be sown. If this be done in early spring, a nice green sward will soon be the result. When mowing is required, it had better be performed with the scythe in preference to a mowing-machine for the first two or three months, till the young plants are well established. During dry weather it will not do any harm to pass a roller over the surface, but rather serve to crumble down any slight unevenness that may exist. If turf is laid instead of the sowing of grass-seed, the same should be taken up where the pasture is not of an over-luxuriant nature. Turf is oftentimes cut much too thin, this being more easily accomplished, and such turf being of less weight in carriage. An inch and a quarter to an inch and a half will be about the thickness; in superficial measurement these are generally cut three feet in length, by one foot in breadth; this is the recognised size in purchasing turf. We advise the sowing of grass-seed, however, both as being more economical, and as *eventually* forming by far the best lawn. A good reliable selection of grass-seed for such purposes will be composed of the finer-growing kinds of grasses, those of more luxuriant growth not being included in such mixtures.

This description of suburban and town garden will not allow of much space for kitchen garden produce, and neither is it advisable to devote any considerable extent to the cultivation of vegetables under such conditions. Any kinds that require a good amount of room should not be included, as the trouble and extra expense will not compensate for the outlay. The same remarks apply with equal force to fruit culture. Some part of the division walls may be turned to a good account for easily-grown fruits of hardy constitution; but both vegetable and fruit culture will be more fully commented on in another article.

The accompanying illustrations will afford two examples of how the gardens of many similar semi-detached villa residences might be arranged. The illustration marked No. 1 shows both a front and a side entrance, which is generally to be preferred for reasons requiring no explanation from us. Supposing the division walls to be of brick or fence, in either case one object should be to contrive to hide the same as soon as possible. By the aid of a few extra tall shrubs and slight mounds this could soon be accomplished. We would not advise the planting thickly of one given kind of plant to form the hedge. This should only be done when used by itself to form the boundary. A rapid-growing climber, as the Irish Ivy, would, for the time being, be suitable to hide portions of the wall not shut off by the shrubs themselves. Those of the shrubs which are planted next the house should, on the other hand, be kept low; Rhododendrons, for instance, would be suitable just there. Two or three climbers might be trained up the wall; if a south or west aspect, Roses would be excellent; if either north or east, either the Virginian Creeper, or *Euonymus latifolius*, would do well; the latter, although a shrub of bushy habit, is also an exceedingly pretty wall-plant of good free growth; but future articles on climbing plants will discuss such matters more freely. On the grass-plots are shown some dots; these denote standard Roses. A hedge of evergreen Privet would be advisable next the back path; this could soon be got to a good height as a screen to the same. The shrubs next to this should be of a mixed character. A small triangular piece next the house is marked for Ferns.

At the end of the house is shown a small conservatory. This, if the dwelling is entered by a flight of steps, could be carried up by brickwork to the same level, leaving sufficient space underneath (with a trifling excavation) for a tool-house, &c. The conservatory might with ease be heated from the kitchen boiler, or by a small gas-boiler fixed underneath, and attached to the pipes fixed in the conservatory itself; the former would, we think, be the better plan. Next to the conservatory on the garden front of the house comes a suitable corner for a rockery, bounded by the path leading to the bottom of the garden and

to the garden entrance of the house. Along the walls of the house, some Tea-scented Roses (both dwarf and climbing) would find a congenial home if it should be a sunny aspect. Following down the side next to the division wall, the planting of mixed shrubs should be continued, till the bottom of the lawn is reached. This being a rather wide border, some room along the front will be very suitably filled with hardy herbaceous plants. At the corner of this shrub border, there is a space marked out for an arbour or summer-house. Along the bottom of the garden and facing the house will be an excellent position for Rhododendrons and other showy flowering plants. Some dots denote standard Roses, or, in lieu thereof, a weeping Ash could be substituted. Two flower-beds are shown, one on each side of the foregoing. A thin edge of evergreen Privet should shut off the lawn from the small plot allotted either as a kitchen garden, or for the special culture of Roses, Carnations, Pinks, and hardy plants for cutting purposes. The wall at the bottom of this garden can be covered either with evergreen climbers or Morello Cherries, if a north or east aspect; with climbing Roses, Peach-trees, Pear-trees, or red and white Currants, if either south, south-west, or west aspect. Tomatoes might also be grown on the same wall, as long as there is room. The shrubs bounded by the path leading to the house from the lower garden should be of a mixed character. A few tall-growing trees along this side would not look amiss, such as a few Limes, or here and there a Copper Beech and a Laburnum. One flower-bed is shown on this side about half-way up; this would do for rock-plants or other hardy flowers. Space is allowed in the centre for a lawn tennis ground of the usual size.

In the plan marked No. 2, the arrangements will be seen to be different. One pathway only from the house is shown, branching at the corner for access to the garden and side entrance to the house. The dots denote Roses, as in the former case, and a trellis is shown for climbers to screen the garden front of the house. On the garden side of this trellis is shown a rockery with a small grass-plot in front, bounded by the side path. In the recessed corner is shown a spot for ferns, by which passes the path extending along the entire length of the house, with a garden entrance in the middle. Standard Roses are there shown on the turf, with a flower-bed in front of the entrance, and a rather large clump of shrubs and border plants, to shut off the end of the house from the lawn. Following the line of the path from the corner of the building, we find one side of it is the boundary for the foregoing clump, and on the other is a narrow border with a break of Roses half-way down the garden. The wall could be covered with climbers or fruit-trees as in No. 1, and the border itself with strawberries or any other low-growing plant. A flower-bed is shown near the Roses, and lower down a narrow belt of shrubs that is extended round to the corner, in which is shown a summer-house; some dots also denote Roses or a weeping Ash. The narrow belt of shrubs on the division side will be sufficient to hide the wall with the aid of a few creepers. Several plants mentioned for No. 1 would also be suitable in this plan. The tennis ground is again shown, with a back-garden entrance in the outside corner.

The object aimed at in both of these plans has been to avoid any uniformity or strict formality, any repetition being avoided in the designs as much as possible, to give as great a diversity as could well be secured in gardens of such limited extent. We must leave for the present the enumeration of such suitable trees, shrubs, herbaceous and other plants, as will best thrive in suburban and town gardens.

THE FLOWER GARDEN.

By William Wildsmith.

SITE, STYLE, SOIL, AND FORMATION OF THE GARDEN.

SOME one has said that beauty is really more useful than utility. Probably it is so. Measuring use by mental and moral, as well as physical considerations, no doubt almost the highest place must be assigned to beauty. The love of flowers is more refining, ennobling, satisfying, than the love of meat, bread, vegetables, fruits. It is a higher taste, and yet a purer pleasure, because less utilitarian. Flowers are the choice dessert of life; the solace of life-sorrows; the sweeteners of life's acids. Flowers were late in the order of development. For ages the world was clothed with flowerless vegetation; or, to write more correctly, only those of algæ, mosses, or ferns were hidden in the dense rank greenery of those times. But before man was ushered on the scene, the flowers were prepared in all their brightness and beauty; and ever since, a hidden link binds the human race in closest bonds of sympathy and affection to the fragrant and beautiful flowers. They are the first ambition of babyhood; the last thing the old and the sorrowful lose their hold of. Hence our desire to make each flower garden, whether it decks a cottage or adorns a palace, larger and yet more beautiful.

Flower gardening, pure and simple, as distinguished not only from pleasure-grounds and landscape gardening, but apart also from the Rose garden, is the subject we purpose treating of, alike

from a popular and a professional point of view. We trust to refresh the memory of the professional gardener, guide the faltering steps of the amateur, and teach the shopman and the artisan on all matters relating to the forming and furnishing of their flower gardens.

The great and still increasing interest that of late years has been taken by every class of the population in all that concerns horticulture, is a cheering sign of the advancement, education, and refinement of the people. That flower gardening is the favourite branch of horticulture, none will doubt who have witnessed the crowds of admirers the flowers attract, on Sundays and holiday times in particular, both in the metropolitan and provincial parks. As might have been expected, this appreciation by the general public has had a corresponding effect on every gardener, and still more on every one professionally connected with gardening, so that now every one vies with his neighbour as to who shall be first in the race with anything in seeds, plants, or flowers, that may be thought to be an advance on previous introductions. The fact that the writer has been one of the most susceptible of mortals to the flower gardening fever, must doubtless be credited with his selection for the task he has undertaken, to treat upon flower gardening from *his* point of view.

Garden in Old-fashioned Picturesque Style.

Position for a Flower Garden.—This is a point of great importance, but obviously circumstances must govern the selection in by far the greater number of cases. As a matter of course, the ruling point must be the position of the house or mansion, because, to get the largest amount of pleasure from the flowers, they should be so placed that they may be admired independently of the weather. Not that it is undesirable to have flowers elsewhere, as our remarks will presently indicate; but, first and foremost, provision should certainly be made for flowers "close at home." There are mansions and houses so unsuitable, with regard to

the form of ground, landscape, and general scenery, that to place flower-beds of formal design in front of them would be the height of bad taste. These positions we shall presently indicate; but, as a general rule, the nearer the flower garden is to the house, the more will it be appreciated. All objections as to not liking to see workmen about, or to the litter and untidiness consequent on mowing and clearing up, are not worthy of being entertained; these operations, to real lovers of a garden, being part and parcel of their pleasure. Not but that there are times when privacy from workmen, &c., is desirable; but those times, by sensible men, are very soon learnt, and assured to their employers by arranging the work at stated hours.

This point—the garden close to the house—being accepted, the *position* must also be accepted as a foregone conclusion, except in those cases where there are two fronts, when the least objectionable with regard to the well-doing of the plants should be chosen. Aspects with a southern, south-west, or western exposure are all of about equal merit for flower garden purposes. Colder exposures may answer in favoured parts of the kingdom; but so many tender plants are now used—and that, too, with splendid effect—that the warmest aspects, for this reason alone, ought to be selected. But there are other considerations that must govern the precise position to a certain extent.

Style.—Here again the question of house, mansion, and surroundings must decide whether the form of beds and general treatment shall be old-fashioned picturesque, symmetrical, or of the true geometrical type.

The first type consists in laying down almost any form of beds, but principally ovals and circles, without any regard to regularity, but just in such spots as the operator conceives will give the best effect. For an old-fashioned mansion of the Elizabethan order, standing in a slightly elevated position, and well surrounded with shrubs as backgrounds for the flowers, this plan answers admirably, if a further *informality* be attended to, viz., that no attempt be made at arranging the plants in the beds in a formal manner. They should either consist of mixed herbaceous plants, or, at most, *two* colours in a bed of ordinary bedding-plants (see illustration).

The *symmetrical* and *geometrical types* may, for all practical purposes, be classed as one; being, as they are, but complements of each other, the one adding grace, and what may be called freedom of outline, to the necessarily rigid angles of the other. The two in combination may be termed the *free geometrical* style, a style which the present system of bedding out has rendered generally popular, and which is the prevalent mode of laying out gardens. It is, we think, generally speaking, a long way the best mode; but, for all that, it is not suited to the architecture of all houses, or to the form of ground in some places. For instance, when the general view of the landscape is on a level with the view from the house, intervening beds of flowers, and especially geometrically formed beds, look, and are, quite out of character with the repose of such a flat landscape. If a flower garden of this kind must be be made where the landscape is of this description, the least objectionable plan is to bring it as close as possible to the house, that the view be not intercepted by the plants; but a far better method of meeting the difficulties of the case would be, so far as flowers are concerned, to be content with a border of them close to the wall of the house, and then in the nearest available position, outside the range of such landscape scenery, to find another site for the "flower garden" proper. A deep recess amongst shrubs, or an opening on the lawn that cannot be seen till the spot is reached, or the ground in front of forcing-houses, or the entrance-borders to the kitchen garden—these may all be treated in free geometrical style.

But a mansion or house situated on a *rising* knoll, of even but a few feet above the general landscape (if higher, all the more appropriate), and where terrace-walls are necessary to insure evenness of ground, as well as to aid the idea of massiveness by giving a broader base to the mansion, furnishes the best site for a geometrical garden. By this term we would not be understood to mean all and every sort of intricacies and unmeaning designs worked out in box, stone, terra-cotta, coloured gravels, sand, and the like; but simple geometrical figures, cut out on turf, of such size and form as best suit the surroundings, the leading idea being that there shall be nothing to offend the most cultured eye when contrasting the architecture of the garden with that of the mansion. Should the latter be of the Gothic order, straight lines and pointed angles may be the prevailing form of the beds, though certainly not to the exclusion of good bold circles and ovals; but these latter should occupy the central position. For a massive, plain-built house, ovals, oblongs, and circles are most in keeping; and there should be no crowding of beds, as good broad belts of turf between each add to the general effect of the whole, particularly when in full growth or flower; a wide margin of turf being then necessary to prevent any approach to gaudiness by a too close juxtaposition of colours.

The size of the ground to be treated will also in some measure affect style; for if the ground be small the designing must be proportionately simple, and if

large, then elaborateness may have full play, so long as it does not develop into incongruity. Simplicity of design, however, even on the largest scale, wears best, being the most lastingly beautiful. The style of garden for old-fashioned flowers, as the perennial and herbaceous section are called, may be of any description, but the *rigidly formal*—good wide borders in front of shrubberies, or large circles by the sides of walks in distant parts of the pleasure-grounds, or a series of circles, squares, and ovals in some secluded part of the ground—always seems the most appropriate. Though relegated to outlying situations, it is, however, just as important that they should be well cared for in the matter of culture as those most favoured in regard to position.

Formation and Soil.—The first consideration under this head is naturally that of *draining*. A waterlogged, heavy, retentive soil is several degrees colder than a well-drained soil of the same description, a fact that cannot be too deeply impressed on the minds of all who desire to excel in flower gardening, particularly in those branches now so popular, namely, carpet and sub-tropical bedding. Many of these classes of plants are so tender, and our seasons so cold, that it behoves us to spare no pains to obtain the best results. Clay soils are the most unkindly possible for all flower garden plants, as for the most part these are thread-like rooters, and cannot pierce such descriptions of soil, and it will only prove labour in vain to attempt to make them do so.

Drainage is not all the preparation that clay soils need before they are fit for flower garden purposes. They will have to be pulverised by deep trenching and exposure to the atmosphere; and the addition of ashes, vegetable mould, or in fact any description of material that will have a tendency to porosity and lightness. If the clay be very tenacious, the dearest, and yet the cheapest (because the most effectual), mode of treatment is to burn, or rather, char it. This is done by collecting all the brushwood, sticks, hedge-clippings, and any other material that will help to create a body of fire, on which the soil must be placed, turf side downwards, and of any bulk, so long as the fire is not put out owing to being too heavily weighted. To save time, if sufficient firing material is to be had, several mounds may be started simultaneously, at convenient distances on the ground, to save wheeling both before and after charring. This will be dealt with in more detail in treating upon the amelioration of soils.

Whilst this process is going on, the drains may be laid; and in such a retentive soil not only the place where the beds are to be—as is sometimes done—but the *entire* garden should be drained, otherwise a heavy rainfall will just make the part drained a reservoir for the water falling on the undrained land. Drainage will be treated elsewhere; and we only need say here that the drain-pipes for clay soil ought to be three inches in diameter, and eighteen inches deep from the surface, laying over them whatever rubble or clinkers may be at command, and each series of drains should not be more than nine feet apart. This work completed, any description of light soil that is to be had may be spread over the whole surface, and when the charred soil is ready, spread this also equally, and trench as deeply as the top of the drain-pipes, or rather of the rubble that covers them, well incorporating the soil as the work proceeds. For land that is less heavy, or what may be termed of moderate texture, drain-pipes of two inches bore will be ample, and they may be laid deeper, from twenty to twenty-four inches, and each series need not be nearer than from twelve to fifteen feet; but, as in the preceding case, there ought to be no partial draining; all the ground must be treated the same. Very light soils—the best for flower gardening—if deeply cultivated, do not require any artificial draining, other than a trench of rubble at the lowest parts of the ground to carry off the water that naturally collects there after heavy rain-storms.

Draining over, next comes *levelling;* but before this can be done the design must be decided on, and roughly sketched upon the ground. This is important; otherwise, the best soil may be wheeled where it is least wanted, and *vice versâ*. It need scarcely be remarked that the best soil ought to go to the proposed site of the beds and trees, as any description will do for the turf; and here it may be remarked that "gravel and box beds" are not approved of by the writer of these articles, turf alone as a cushion for the flower-beds being at once the most natural and beautiful.

Supposing that the garden now under consideration is to be laid out after the plain geometrical form recommended, the ground having been got somewhat into shape, the marking out of walks is the next item. The length will of course be that of the garden, but the width is only determinable on the spot, size of garden and height of house or mansion having to be taken into account; six feet wide is a fair average walk, but in some positions double that would be none too much. Though the land-drains run through the walks, they ought not to be considered as ample for these, but additional ones should be added, with abundance of brick rubble and clinkers; then they will not only always be dry, but free of moss and weeds. (See also Garden Walks.)

The detailed marking out of the banks, beds, and borders then follows. After rolling and getting the

ground in order, the tools or instruments needed are lines, measuring-rod, tape, level, borning-rods, pegs, and stakes. The design having been well wrought out on paper, and roughly sketched upon the ground, for the purpose of putting the best soil where it will be most required, exactitude and correctness are the only injunctions needed to the successful working out of the designs.

Turfing, and Planting of Permanent Plants.—It is presumed that the ground was well rolled and beaten down before the final marking out was done; and, the lines being still intact, the turf ought to be laid an inch over the marks, to admit of cutting the edges straight after the turf has been beaten or rolled down. Banks and slopes require much care and labour to get them to the same angle and firm throughout. Perhaps the most certain way of securing this is to add three or four inches more than will finally be required, and after beating very hard, to put in the levelling pegs to the exact angle, and shave off the surplus soil with spades. By stretching a line from a peg at one end to that of the other, correctness of outline will be assured.

The edgings being cut, the soil of the beds should be dug up, and left rough till planting-out time, but the planting of shrubs and hardy plants generally should proceed at once. To what extent these should be present on a parterre or formal terrace garden is a moot point; but at any rate there should be a goodly sprinkling of shrubs, if only to take off the appearance of baldness at the dull season, when the beds, if not empty, are virtually in that case, so far as any life-imparting properties are concerned. Our own inclination is not only to use plants as sentinels on the grass, as a break to the various plots of beds, as well as at the angles of walks, but also in the centres of the flower-beds, thus in some measure securing permanency of furnishing all the year round. This does not in any degree detract from the summer effect, but rather heightens it, there now being many shrubs that harmonise in general contour of growth and colour with the rarest sub-tropicals.

The clipping and shearing of trees and shrubs into all sorts of ridiculous forms and shapes, which once was general in gardens of formal design, is fast becoming obsolete, and that without a pang of regret from any one. Yet the notion had some merit, and might, perhaps, have been continued up to the present time, had not there been such rapid advances made in raising and introducing many kinds of shrubs of a sufficiently formal type without having recourse to the shears. Such are *Cupressus Lawsoniana erecta*, about a dozen kinds of *Retinospora*, several Junipers and *Thujas*. Besides these there are older types of plants, such as Yuccas, variegated Box, golden Yews, Hollies, &c., which are just as useful and appropriate for terrace-planting as are the first-named. In addition to these classes of plants for isolated positions on turf or the middle of beds, there are others that may be pressed into the service of the parterre for flanking a wall which it may be desired to conceal, or for making a hedge in lieu of a wall. The best of this class are *Cupressus Lawsonii* and *Thujopsis borealis*.

It only remains to add that, as soon as planted, supports should be applied to each plant to prevent wind-waving, which not only throws them out of the perpendicular, but breaks off new rootlets, and, in consequence, materially checks the growth of the new plants.

FERNS.

By James Britten, F.L.S.

INTRODUCTION.

BEFORE proceeding to describe the more important groups of ferns, we will devote a few lines to pointing out how ferns differ from flowering plants. The absence of blossoms at once strikes the observer: the place of these is supplied by the variously-shaped groups of small bodies which we shall notice on the back of the fronds—sometimes being arranged in round groups of the size of a pin's head, sometimes larger in circumference, sometimes placed in long lines, and always of a yellow or brownish colour, and covered to a greater or less extent with a membranous scale. The small bodies are little capsules (called *sporangia*), which contain the *spores*, these being analogous to the seeds of flowering plants; the round or narrow groups of sporangia are called *sori;* and the membrane which covers them is known as the *indusium*. When the spores are set free by the bursting of the sporangia, and fall in a damp place, they shortly germinate. The result is—not a young ascending plant and descending root, as in flowering plants, but—a very small membranous green body, which lies flat on the ground, and sends out delicate rootlets from its under side. This is known as the *prothallium*. On this prothallium are produced minute bodies which, speaking generally, correspond to the stamens and pistils of flowering plants. The male bodies are called *antheridia:* they are minute cellular sacs, which, when ripe, burst, setting free a number of spirally-twisted moving bodies, called *spermatozoids*. The female bodies are called *archegonia:* they are bottle-shaped, and contain a minute cell at the base, called the *oosphere*. Fertilisation takes place by the action of the spermatozoids on the oosphere: passing down the neck of the archegonium, they fertilise

the oosphere, and the new plant is formed. This draws its nourishment in the first instance from the prothallium; but the latter presently disappears, and the young fern begins to put out independent roots.

Geographical Distribution. — Ferns require shade and a damp atmosphere. They are most abundant in tropical America, where they reach their maximum concentration "amongst the dripping rocks of the higher level of the Andes, the forests of their slopes and ravines, and the dense humid flats that border the innumerable branches of the Amazon, where the sun's rays and the wind never penetrate the recesses of the primeval jungles, and climbers and parasites contest with the leaves of bright flowering trees for the possession of the branches." Mr. Baker, from whose paper on the subject we quote the foregoing passage, summarised the distribution of ferns thus: —Tropical America, 950 species (42 per cent. of all known ferns, three out of four not being found elsewhere); tropical Asia and Polynesia, 863 species, 427 being peculiar; Polynesia, 380 species, 150 peculiar; tropical Africa and islands, 346 species, 127 peculiar; south temperate America, 118 species, 32 peculiar; temperate South America, 153 species, 21 peculiar; temperate North America, 114 species, 37 peculiar; temperate Asia, 413 species. This estimate was published some years ago, but it is still approximately correct, considerable additions having, however, been made to the Madagascar fern-flora especially during even that short period.

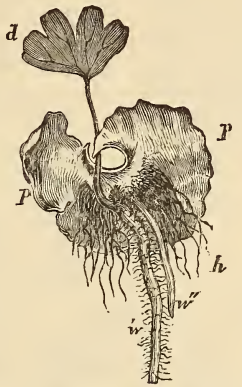


Fig. 1.—Prothallium of Maidenhair, seen from below, with young fern attached. *p p*, the prothallium (magnified about thirty times); *d*, the young fern; *w w*, its first and second roots; *h*, root-hairs of prothallium.

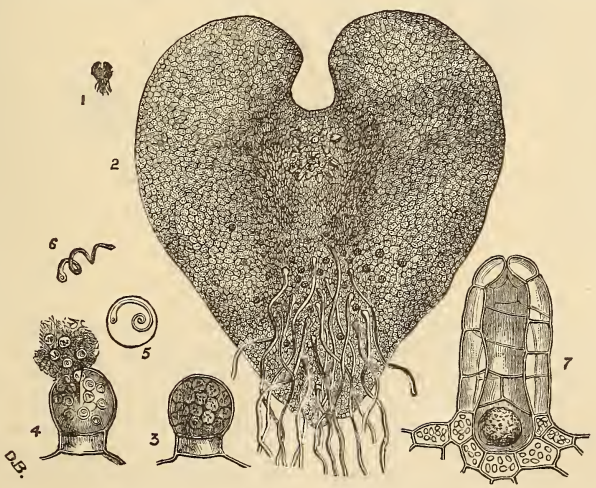
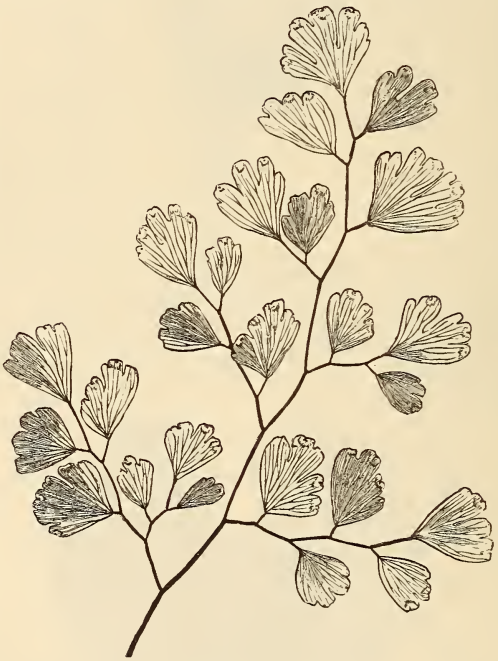


Fig. 2.—1, prothallium of Male Fern (natural size); 2, the same, much enlarged; 3, antheridium before bursting; 4, antheroid cells escaping from antheridium; 5, antheroid cell; 6, antherozoid or spermatozoid; 7, archegonium (all much enlarged).

Maidenhair Ferns (*Adiantum*).—Few genera of ferns are more popular than this, including as it does the various forms of Maidenhair; so universally admired for the graceful lightness of their delicate green fronds, which the dark stalks throw into greater prominence; and so invaluable to the gardener from the profusion with which these fronds are produced. Perhaps no ferns are so much used with cut flowers as the Maidenhairs. Extending widely, as they do, over the tropical and temperate regions of both hemispheres, they find their headquarters in tropical America. About a hundred species of *Adiantum* are known, and a large number are in cultivation. Of the species requiring stove treatment, one of the most peculiar, although perhaps not of the most beautiful, is *A. reniforme*, a native of Madeira and Teneriffe. This is distinguished at a glance by its simple roundly kidney-shaped fronds, about two inches across, having the sori situated all round the edge; the stems are tufted, from four to six inches high. A variety, known as *asarifolium*, comes from the Mauritius; while an allied species, *A. Parishii*, is a native of Moulmein and the Malay Peninsula: these form a little section of the genus very distinct from the remaining species. *A. trapeziforme* is a well known, handsome plant, of wide distribution from Mexico to Brazil. It grows from six inches to a foot high, with stout, erect, shining, dark stems, and a very few spreading pinnæ, which are trapeziform in shape, having the numerous sori placed round their upper edges. *A. lunulatum* has wiry dark brown stems, and slender pinnate fronds of thin texture, a foot, or often less, in length. These are frequently elongated at the apex, and take root, as is also the case with the allied *A. caudatum*, which is very much like *A. lunulatum*, but of a leathery texture. *A. lunulatum* is widely diffused in both the Old and

New Worlds; *A. caudatum* is confined to the Old World. *A. lucidum* is a handsome West Indian and South American species, a foot or more high, of robust growth and erect habit; the leathery fronds are simply pinnate, the terminal segment being larger than the rest, having from six to ten smaller ones on each side: *A. macrophyllum*, having much the same distribution, resembles it in habit, but has fewer pinnæ, the lower ones on the barren fronds being so broad that the opposite ones often overlap; in a young state the fronds are often beautifully tinged with red. Two South American species, *A. Feei* and *A. digitatum*, are remarkable on account of their long climbing stems, which are a foot or nearly two in length, with numerous branches. *A. tenerum* is a West Indian and South American plant, much like our common Maidenhair, but larger and more branched, with smaller segments. To this species is often referred as a variety the very beautiful *A. Farleyense*, which is perhaps too well known to need more than a reference, with its dense masses of softly green and gracefully drooping fronds, the barren pinnules being elegantly fringed, and the young fronds being of a delicate pink colour in their earlier stages. It is, however, interesting inasmuch as its origin has not been definitely traced. The first specimen known came up accidentally among some ferns sent from Barbadoes by a gentleman, whose residence (Farley Hill) suggested the name of the plant. It has been stated, however, that seedlings of this fern have produced examples of *A. seutum*, in which case it would be referable to that species. *A. Farleyense* was first brought into notice at a show of the Horticultural Society in 1865. The plant most grown and used as Maidenhair is *A. cuneatum*, although our British *A. Capillus-veneris* (which we shall consider later on) generally lays claim to that title. Although now so common, it was not introduced to this country until 1841; but the ease with which it is grown caused it to spread with great rapidity. It grows very readily from self-sown spores. The pinnules are smaller than those of *A. Capillus-veneris*, and the fronds thus have a more slender and graceful appearance. It is a native of Brazil. A variety known as *elegantulum* has much smaller pinnæ, and thus assumes a very delicate and graceful appearance. The farthest point in delicacy and grace is, however, reached by *A. graeillimum*, a plant with the growth and habit of *A. cuneatum*, but with fronds composed of pinnæ so delicate that they have an almost lace-like appearance. Although distinct enough for garden purposes, the plant is doubtless a form of *A. cuneatum*. *A. digitatum* is a very beautiful species, with lax habit, long fronds, and distant deeply-cut pinnules. It is a native of Brazil and South America. *A. rubellum* is a small Peruvian species, noticeable for the pink hue with which it is tinged, the young fronds being purplish crimson.



ADIANTUM CUNEATUM.

Cultivation.—Most of the *Adiantums* are easily managed; there are probably none of them which would not thrive in a mixture of peat, loam, and silver sand in equal parts, with, of course, due attention to secure thorough drainage. Good leaf-mould, when procurable, might be substituted with advantage for the peat, which is by no means so indispensable for the good cultivation of ferns as most gardeners seem to think. Indeed, some of the finest plants of *A. cuneatum* we have ever seen were grown in pure loam, and potted almost as firmly as a heath. The latter plan enables growers to obtain good specimens in comparatively small pots, a consideration of no small importance in many instances, besides reducing to a great extent the danger of over-watering. Plenty of light and air are essentials. Of course, direct sunlight, as in the case of most ferns, must be avoided.

It is almost impossible to draw a line between the stove and green-house kinds, as most of the thoroughly tropical ones will succeed well under

green-house treatment with proper care. Even *A. Farleyense*, although growing more rapidly in a stove temperature, is not difficult to manage in a green-house, and cut fronds from plants so treated keep fresh much longer than those furnished by plants grown in heat. As a matter of course, plants themselves from the cooler quarters stand much better either for the temporary or permanent decoration of apartments, &c. Provided the atmosphere is fairly well charged with moisture, syringing overhead should not be practised, as the species with densely-packed pinnules often become discoloured and much disfigured by the water remaining among the clustered fronds.

Many of the Maidenhairs are amongst the easiest of ferns to raise from spores; and as good plants, by proper management, can be obtained in less than a year by this method, recourse to it, in preference to dividing the roots, is depended upon by growers on a large scale. The fronds with ripe sporangia should be cut and placed on a sheet of white paper in an airy place for a day or two. The spore-cases burst, and allow the spores to fall on the paper, when they may be sown at once. Well-drained pots should be filled with loam and sand made quite firm at the top, and well watered. The spores should be sown on the damp surface, and then the pot placed in a saucer of water in a shady place, and a piece of glass put over the top. If the saucer be kept full of water, capillary attraction will suffice to keep the soil moist enough, and the danger of washing away spores by watering overhead will be avoided. After the spores have germinated the glass should be partially raised, to allow more air; and the young prothallia can be pricked off into small pots, and treated like any tender seedlings.

Adiantum Capillus-veneris.

HERBS AND SMALL SALADS.

By William Earley.

IN view of furthering the original intention of this work, to make it a book for "ready reference," it is deemed expedient to place the many varieties of kitchen-garden grown plants, known variously as *herbs* and the minor forms of *salad* plants, in one alphabetical list together, this being the more convenient, especially when it is considered that accordingly as individual tastes vary, so are varieties of herbs proper, used and utilised in salad mixture as desirable ingredients.

As the two terms are not too well understood by some growers, it may be convenient to explain them. Herb—*i.e.*, Latin *herba*—is simply a plant with soft or succulent stalk, which dies to the root every year, as grasses do. Salads are simply all kinds of raw herbs dressed for use as such, and are therefore thus simply separated from all vegetables used for culinary purposes, though some are useful for both.

It will be observed that no hard-and-fast rule exists in regard to any. The term herb must therefore be read in the sense of being a useful and convenient mode of nomenclature rather than as being exact, for even the dwarf-shrub-formed Thyme and Sage are considered such.

Angelica (*Angelica officinalis*). French, *Angélique;* German, *Engelwurtz;* Italian, *Angelica.*—This is a stately biennial plant belonging to the Umbelliferous order, and an inhabitant of Lapland, besides being indigenous in this country. Under a proper system of culture it will thrive and exist beyond the wonted time of biennials proper. The plant grows

to a height of four or five feet, having very ornamental and stately pinnate leaves, and heads of greenish-white inflorescence. The whole plant is highly aromatic. Occasionally the stems are blanched and used in a similar manner to Celery. More frequently, however, the stalks are cut down during the month of May in each year, and are candied for use as a preserve. When well grown, the plant is ornamental besides.

As its native home is invariably moist lowlands, it thrives best in such a position. Seeds are best sown during the month of August in a drill row. So soon as the young plants are a few inches high, transplant them into rich moist ground about three or four feet apart. The whole of each plant should be cut down to the ground-line annually early in the month of June, when an abundant successional supply of young shoots will form.

ANGELICA.

Anise (*Pimpinella anisum*). French, *Anis;* German, *Anis;* Italian, *Anice.*—This plant is generally grown in gardens for use in a similar manner to Fennel, and for garnishing, being extensively cultivated in Spain for distillation, &c. It is an annual plant, originally introduced from Egypt during the middle of the sixteenth century.

Its culture is simple, though it will not transplant readily. A warm sunny border should be prepared for it, and the seeds sown about May 25th. Shallow drill rows six or eight inches apart will best suit it, covering the seeds over very thinly. So soon as the young seedling plants are large enough, thin out all the lesser ones from amongst them, leaving each strong one to be retained, standing free and alone.

Balm (*Melissa officinalis*). French, *Mélisse;* German, *Melisse;* Italian, *Melissa.*—The Balm so popular in old English gardens, though seldom utilised for purposes for which it used to be grown, nevertheless, as one of the most fragrant of all aromatic plants, is still very generally retained in the herbary. It is a hardy perennial, and a native of France and Switzerland. To insure a constant supply, it is only necessary to divide the plant each winter or spring into as many parts as necessary, as every division having a few roots attached will grow most readily. It will thrive in any ordinary garden soil.

Basil Bush (*Ocymum minimum*). French, *Basilic;* German, *Basilikum;* Italian, *Basilico.* — This, the Bush Basil, otherwise known as the Least Basil, is an annual plant used much for flavouring, &c. It is a native of the East Indies. Seeds, to produce the annual supply of plants, should be sown in pots or boxes during the latter part of the month of March in each year. The young plants therefrom, when sufficiently grown and somewhat hardened by moderate exposure, should be transplanted on to a warm sunny site with rich soil, about six inches apart. It is important that a little soil should be maintained around the roots when transplanted, in view of which the young seedling plants may be transplanted when very young into nursery boxes to grow them on, and sufficiently wide apart so to do. They require watering in, and slight shading for a day or two subsequently.

Basil Sweet (*Ocymum Basilicum*) is the larger species of these culinary aromatics, and is the species most generally in demand. Like the former, this also is a native of the East Indies, and equally tender, if, indeed, not more so than the former. The culture of this species should resemble that given above. As the leaves of this latter are much larger than the "Bush" variety, it is certainly the most desirable to grow.

Both are grown until they form and commence showing flowers, which is during the month of June or July, at which time they are pulled up by the root and dried for winter use. An airy shed, where too much sunshine does not penetrate, is the best place wherein to dry them.

Borage (*Borago officinalis*). French, *Bourrache;* German, *Boragen;* Italian, *Borragine.* — Borage is strictly a perennial plant, though its more general habit under generous culture often causes its succulent growth to die away after the first summer. Its uses are for inserting into cool tankard drinks, for garnishing, and the manufacture of nitre, &c. It is one of the best plants also for growing to afford bee-food. Its culture is of the very simplest.

Seeds are sown in an open sunny situation from March until May to produce the summer supply, and during the months of August and September to produce young leaves during the winter. It will thrive in all soils, though highly-enriched deep loams give the best results. It is not customary to permit the

BORAGE.

plants to bloom where the green shoots and leaves are greatly in demand. Its bright blue flowers are, nevertheless, extremely pleasing, and a few plants may, with satisfactory results, be permitted to do so.

Capsicum.—This is the Latin name of certain plants, called variously Guinea Pepper (*Capsicum annuum*), Bell Pepper (*Capsicum grossum*), Cherry Pepper (*Capsicum cerasiforme*), and Chili Pepper: this last name being somewhat explanative of the generic one. (French, *Piment;* German, *Spanischer pfeffer;* Italian, *Peberone*). The species of Capsicum generally cultivated is the somewhat tender annual. Seeds should be sown during the month of March each year, and be maintained in a warmth of between 58° and 60°. When the young seedling plants attain to two or three inches in height, divide and transplant them carefully into other small pots. It is convenient to place four plants around the inner side of very small pots. When these have made progress, and the roots are meeting in the soil, remove the ball carefully, break it into four divisions, each having a plant attached, and give to each the final potting into thirty-two-sized pots. The soil they delight in consists of a moderately stiff fibrous loam, and about a sixth part of decomposed manure added, with a sprinkling of sand. Press the soil moderately firm in process of potting. Thenceforward the plants must be maintained in full sunlight, and receive a regular supply of root-moisture. After the advent of the month of June, they will do well in a cold frame, with the lights kept somewhat close.

During fine warm summers crops may be grown in the open border. The seeds should be sown as above about April 1, and grown on in small pots similarly also till about June 1, at which time prepare upon a warm site a rich bed somewhat elevated above the mean level of the surrounding ground, and transplant the young plants out six inches apart thereon. Still more advantageous will it be to form a bed with fermenting materials beneath before the soil is placed wherein to plant them. They may likewise, where the convenience exists, be planted out into a bed of rich soil within a frame or pit. It is important, however, to have the plants well elevated, so that their heads, when growing, shall be near to the glass. The small-fruited Red Chili is somewhat hardier than the larger form designated Capsicum, and should be used for out-door work.

Many greatly improved forms exist, Monstrous Red being very large. Other desirable varieties are:—Prince of Wales (yellow); Princess of Wales (yellow); Long Red, Long Yellow, Norcera Yellow, Red Squash, Cayenne, Chili, and Little Gem

Caraway (*Carum Carvi*). French, *Carvi;* German, *Kummel;* Italian, *Carvi.*—The Caraway is a biennial plant, and indigenous in England. It is grown

CARAWAY.

for use in soups, and occasionally the roots are used in precisely the same manner as the Parsnip.

Sow the seeds during the month of March to produce strong plants with fine leaves for autumn and for root-growth, and to produce seeds, which are also desirable to sow during the month of August. Thin the plants out to nine or twelve inches apart. A

deep, rich, loamy soil is desirable. When grown for its seeds, pull up the entire stalk previous to their fully ripening, and lay in a dry shed to ripen in the same way as Celery-seeds are harvested.

Chamomile (*Anthemis nobilis*). French, *Camomille;* German, *Kanielle;* Italian, *Camomilla.* — Garden Chamomile is generally the double-flowered variety of the above—*Anthemis nobilis flore pleno*—though occasionally the normal single-flowered one is to be met with in cultivation. The latter is the most useful, as it contains the peculiar bitter principle of the plant in greater perfection than the double.

Both varieties are partial to a deep and firm sandy soil. They are readily propagated by division of the plants during the month of May, when each side-shoot possessing a few roots will, properly planted, form the basis of a fine plant during the summer following. When the plants are established, the soil between them should be trodden down firmly—indeed, treading over the plants seems to aid rather than injure their growing powers. The flowers, which are used for chamomile-tea, &c., are generally ready for gathering early in the month of July, and are best when dried in partial sunshine only.

Chervil (*Chærophyllum aromaticum*, *C. sativum*, and *C. tuberosum* are the species grown). French, *Cerfeuil;* German, *Gartenkerbel.* — The first, or aromatic species, is somewhat fern-leaved in shape, and is known as Sweet Cicely. Like *C. sativum*, or the Parsley-leaved, it is rather extensively used for salads, &c. Both these species are very easily grown. Sow seeds somewhat thinly, during the months of May, July, and August, upon a light sandy soil, thinning the young plants out to six inches apart when large enough.

Chærophyllum tuberosum is greatly prized on the Continent and some parts of America. Hitherto it has proved too tender to grow and produce its roots well in this country. It merits much more attention than has yet been given to it. The produce possesses an excellent flavour, and is somewhat in the way of the French Horn-carrot in shape, having a "nutty" flavour not unlike the Spanish Chestnut. It should not be sown in the spring, as many, when making a first and only effort to grow it, have done. A nicely-enriched bed on a sunny border somewhat elevated should be prepared for it, and new seeds sown during the month of August for the following year. So soon as the young plants are up and large enough, thin them out to six inches asunder.

Chicory (*Cichorium Intybus*). French, *Chicorée sauvage;* German, *Gemeine Cichorie;* Italian, *Cichoria.* —The Chicory is also called Succory, or Wild Endive, and is the same plant as is grown to manufacture the Chicory of commerce. Its use in gardens is, after the roots are produced, to force or otherwise cause them during the subsequent winter to push forth leaves in a dark confined place, which, being blanched, represent the *Barbe de Capucin* of the Parisian market, and are used plentifully for salads when such well-blanched mediums are scarce.

To grow the annual crop of roots, sow the seeds and cultivate the young seedling plants in precisely the same way as the larger form of Carrots. In the early autumn carefully dig the long white roots up, store them away for the winter, placing successional

Chicory.

batches in a warm dark shed, or similar place, in a layer of soil, well watering them until the young blanched leaves are formed.

A very free hearting variety is that named Witloef, or Large-rooted Brussels; there is also the new Red-leaved.

Chive, or **Cive** (*Allium Schœnoprasum*).— French, *Civette;* German, *Binsenlauch;* Italian, *Cipoletta.*—This very old British meadow plant is not so frequently and so abundantly grown as it used to be a few years ago. Nevertheless, as it possesses the true Onion flavour, but in much milder form, it is far more suitable for salads, &c., than young Onions proper, in instances where—as is not uncommonly the case—either are used. Being an evergreen perennial plant, it has the merit besides of being, during most seasons of the year, in a state fit for immediate use. It will grow freely upon any moderately good soil, requiring only to be divided when the stools become too large. The supply is generally obtained by cutting off the young leaves down to the ground. Others soon form and grow in their place.

Coriander (*Coriandrum sativum*).—The French, German, and Italian names vary but little from the Anglicised one above. The plant is an annual of

very remote introduction, and has been acclimatised in some parts of the country. The young leaves are used for salads, &c., the seeds being in great demand by druggists, distillers, &c. The height of the plant, when full-grown, is about two feet, having double pinnated leaves. A light sandy soil is suitable, and periodical sowings, commencing in March, should be made, according to the demand for it. A late sowing should be made during the earlier part of the month of August, to produce plants for winter and early spring use.

Cress (*Lepidium sativum*). French, *Cresson;* German, *Kresse;* Spanish, *Mastruco.*—This simple plant, so useful for salads, is called Pepper-wort, Pepper-grass, &c. It is extensively grown throughout the whole land, during the summer months in a partially shaded position, and somewhat moist, out of doors; and during winter in boxes of rich soil, sifted finely, within glass structures. It requires sowing thickly, and to be only partially covered over with very fine soil, keeping it constantly damp by means of superficial waterings. The varieties consist of Plain-leaved and Curled-leaved.

The Australian, or Golden Cress, is a somewhat more robust plant, the leaves upon which are of a yellow tint of green. To secure good crops of it, sow seeds somewhat thinly upon a rich border at the foot of a south-aspect wall. Keep well watered subsequently, and whilst growing, to deter too quick running to seed. The young leaves require to be picked off singly, when of goodly size, for use as required.

Dandelion (*Taraxacum officinale*, syn. *Leontodon Taraxacum*). French, *Dents de Lion;* German, *Lowenzahn;* Italian, *Piscia in Letto.*—Though usually an extremely troublesome weed, it should be more generally known that it is one of the easiest-grown and prepared plants for salads, being at once piquant to the taste and very wholesome. Our French neighbours, who are large salad consumers, grow it extensively. Seeds should be sown in drill rows two feet apart in the month of March, and the young seedling plants thinned out to eight inches apart as soon as large enough. Care must be taken to cut down the plants when the flowers appear, else seeds resulting therefrom will be dispersed over the whole district.

Probably the reason why this plant has not received a larger amount of culture in this country is to be found in the fact that it will not blanch so easily as will some other kinds of plants. Yet the cause is not far to search for. Total or perfect exclusion of the air is all that is needful to secure this. Many devices may be resorted to in furtherance. During the winter months inverted pots or boxes, covered over with stable litter, will insure this. The roots may also be dug up and placed in the mushroom house, or some darkened place, covered over from the air. Whenever it is desirable to blanch the leaves during summer, all growth existing upon the plants should be first cut away down to the base, and a box so inverted over them, being somewhat buried in the ground, as to thoroughly exclude the air. French Large-leaved and Improved Early are the two varieties grown for this purpose.

Dill (*Anethum graveolens*). French, *L'Aneth;* German, *Dill;* Italian, *Aneto.*—This herb, which is nearly allied to Fennel, is used in a variety of ways by *chefs de cuisine;* it is a biennial, and a native of Spain, and is of upright growth, somewhat resembling the Fennel. Seeds should be sown in an open sunny situation during the month of April, and when the seedling plants are large enough thin them out to eight inches asunder; by this means a permanent bed will be made for the following season. As the plant is a biennial, however, it will be desirable to sow a small bed of it annually, in extent according to the demand.

Fennel (*Fœniculum officinale*). French, *L'Aneth;* German, *Dillkraut;* Italian, *Aneto.*—This is the well-known "pot-herb," a perfectly hardy perennial now naturalised in many parts of Britain, and is most easily grown. Seeds are sown very thinly, and plants resulting are to be thinned out to at least a foot apart. The plants readily develop into large stools, more especially if the flower-stalks are cut down as often as they push up from the base. Besides

FENNEL.

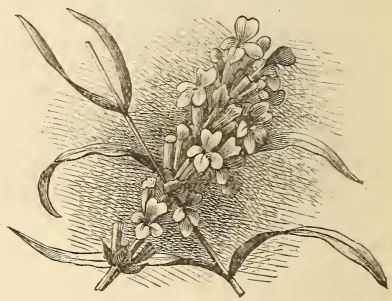
the more common use of the leaves of this plant for sauce, &c., the young shoots, when blanched, which is effected by covering the stools over before growth commences, are also used for salads, as the flavour is somewhat strong and highly piquant; however, such an addition must be made with care. Formerly a variety of Fennels existed, but the cultivation of it has not of late years been so great as of yore, and therefore only one common form seems to have been retained by seedsmen, &c.

Horse-radish (*Cochlearia Armoracia*). French, *Cranson;* German, *Merrettig;* Italian, *Ramolaccio.*—This is a perennial plant found wild, commonly, in England, and mostly in low-lying marsh-lands, which is a fact not always taken into account in connection with its artificial culture. Probably few plants received into the limits of the vegetable garden are allowed to possess their own space of ground, and to subsist regardless of culture and form, in an equal degree. Yet it is in very general demand. Market gardeners, or growers for market, produce very fine sticks. To secure such it is desirable to trench a piece of ground two feet deep, placing a nice layer of manure at the bottom. Subsequently, or during the month of February or March, procure cuttings for planting. Take up old plants, cut away the main shoots, and divide the lower parts of the sticks which remain into lengths of about two and a half inches, carefully removing all minor roots. Now procure a long dibble, and dibble holes into the bed down to the layer of manure. Drop one piece, or cutting, into each hole. They should be twelve inches apart. When the pieces are placed in the holes, fill the spaces above them with finely-sifted cinder-ashes, or sand. The only subsequent attention the young crop will require is to keep the surface free from weeds. It is important to be more particular than is customary in digging up a crop, so grown, for use. To simply insert the spade from above downwards is to cut the produce in two, and to waste about half of each stick. A slight trench should first be made along one end of the bed, in such a manner that each stick when taken up can be exhumed from its very base. To lessen labour, a row or two may be taken up at the approach of winter and laid in store conveniently for use.

Hyssop (*Hyssopus officinalis*). French, *Hysope;* German, *Jsop;* Italian, *Jysop.*—This is a dwarf evergreen shrub, a native of Southern Europe, which receives recognition in all moderate-sized herbaries. The plant produces blue flowers about midsummer, and is powerfully aromatic. Sow seeds during the month of April, and transplant the young seedling plants into rows or beds eight inches apart, during showery weather in the month of June. Small strong side-shoots also root, inserted firmly, and it is propagated by division of the old plants.

Ice Plant (*Mesembryanthemum crystallinum*).—Few kitchen gardens are complete without a few of these very desirable plants for garnishing purposes. Seeds are sown in a small pot and sandy soil, during the early part of April. When placed in moderate warmth the young plants soon form. When large enough to handle, pot each one singly into a very small pot. About June 1, transplant out of doors into rich soil.

Lavender (*Lavandula Spica*, syn. *L. vera*). French *Lavende;* German, *Spiklavendel;* Italian, *Lavendula.*—The Lavender, a dwarf hardy shrub introduced during the sixteenth century from the south of Europe, is popular among all classes. Its culture is extremely simple. It is propagated by means of side-shoots, or rather side-slips, being such as are drawn off from the sides of the main stems, having



LAVENDER.

a heel, or portion of the main stem, attached to their base. These have all ragged edges around such wounds; these are cut away with a sharp-edged knife, when the cuttings are dibbled out thickly into nursery beds in a shady cool position. The month of February is suitable for this purpose. When the young shoots are rooted, which will be seen by the plants commencing to grow somewhat, they require planting out into beds at eighteen inches asunder, or in rows. The most suitable soil is a poor stony or sandy one, moderately enriched. So planted the flowers produced possess more powerful perfume. Besides, the plants withstand severe winters better upon such soil, than when grown on such as is rich. After the flower-spikes are cut, which must be done when most of the flowers are expanded, cut the plants well back, by which means a more bushy and better form will be maintained. There are both broad and narrow-leaved varieties.

Marjoram (*Origanum*). French, *Marjolaine;* German, *Marjoran;* Italian, *Maggiorana.*—Marjorams consist of four or more species. Reference will only be made to three, however, which are the most useful, though not more than two species are in general use, comprising the "Pot" and "Sweet" Marjorams.

Pot Marjoram (*Origanum Onites*) is a perennial dwarf shrub, introduced from Portugal. It is only moderately hardy, and requires to be increased regularly, and kept in thrifty young bush form, else severe and excessively moist winters often destroy it. For this reason a light dry soil is best for it. It is

Common Marjoram.

easily propagated by division of the roots during the month of February or March. Each plant should be from eight to twelve inches apart, and it is well to tread around the plants in the late autumn, should the soil be at all loose, to make it firm, so that less latent moisture may be maintained around their base during the winter months.

Marjoram, Summer (*Origanum Majorana*).—This variety is sometimes called "Knotted" Marjoram, and is often in demand. It is a native of the same country as the former, but is a somewhat less hardy or enduring biennial. It is much safer, therefore, to sow seeds each spring about the beginning of April. Choose a dry, sunny border for the seed-bed, and when the young seedling plants are well above ground, thin them out to three or four inches apart. Where an early summer demand for it exists, it is a good practice to sow a few pots of it during the month of February, thinning out the seedlings, and to plant what remains bodily out of the pots into a rich, warm border about the second week in May.

Marjoram, Common (*Origanum vulgare*).—This is a British plant found abundantly upon most chalk soils, and in a majority of instances it has to do duty for the better kinds. It is extremely hardy, and divides or seeds at will, requiring very little attention to insure permanently large plants.

COMMON HARDY FLOWERS.

INTRODUCTION.

UNDER this general and comprehensive heading it is proposed to include all sorts of old-fashioned plants which may not yet have arrived to the dignity of florists' flowers, nor to the showiness, permanency and effectiveness of those now generally used for popular flower gardening. Besides, there are thousands of readers who have neither the means, space, nor skill to go into the cultivation of either of these classes of plants, who have nevertheless one or more square yards of ground at the front, back, or sides of their houses, which they would gladly make more beautiful if they only knew how to do it at little trouble and cost. All such are cordially welcomed to dip into this "common flower" series, and to plant and cultivate such in their borders, by their walls, or in their tiny beds on the gravel around their homes. For their special encouragement, it may be added here that the pleasure or interest derived from gardens is by no means measured out or determined by their size. On the contrary, it is not seldom true that the smaller the garden, the more of both is reaped from it; the larger, the less pleasure or interest. The land-hunger has proved even more disastrous in the garden than upon the farm, and the fabulous white elephant—excessive size—has too often devoured the pleasures and profits of both alike. As reasonably assess the merits of a picture by rule or tape-line, as those of a garden by its area; the gems of art in either painting or gardening, like those of jewellery, are mostly in the inverse ratio of their size. But while all this is said for the encouragement of small gardeners, the fortunate possessors of large ones have still the best of it if they only have the skill to manage them aright; and any management that excludes common flowers is radically faulty, for the common flowers are after all, as a rule, the most beautiful. Nature, who sprinkles her mineral gems so sparingly in or through the earth, scatters her vegetable treasures broadcast over the surface, and invites all to her feast of satisfying beauty. Gardening may, in a sense, be defined as the setting of her jewels to the best effect; but they are so beautiful in themselves

that placed almost anywhere, they must needs give pleasure and satisfaction. In not a few localities the flowers in window-sill or garden plot are the one touch of nature that makes town and country kin, linking the two together in the indissoluble bonds of a common love for common flowers.

More than that, these common flowers, struggling bravely for life under the most unfavourable and trying conditions, possess, as a rule, a most uncommon and tender interest. Those Gilly-flowers, Daisies, Primroses, Forget-me-nots, are all slips from the plants in the old garden at home, and form more subtle, swift, and constant lines of communication than those of telegraph or telephone. The common flowers suggest common interests, pursuits, tastes, loves; and bind thousands and tens of thousands together who would otherwise be far more widely sundered. The common flowers become the common trysting-places of kindred spirits; and we hope that this series of articles may prove to be among the most interesting and attractive portions of our work.

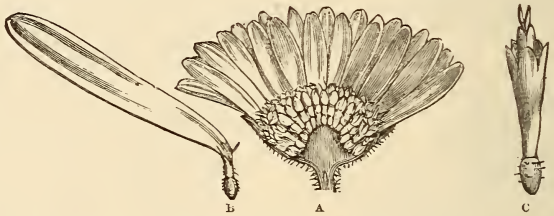


Fig. 1.—Section of Common Daisy. A, section through entire flower-head of the Daisy; B, single floret from margin, showing seed-vessel, and corolla with tongue-like prolongation, forming apparent petal (enlarged); C, single floret from the disc, showing corolla without ligulate prolongation (enlarged).

The Daisy.—Not a few distinct species of plants are known under this name. Such, for example, as the common herbaceous Asters, which flower in the autumn, and are known as Michaelmas Daisies; the Pompon Chrysanthemums, which have been called Chusan Daisies; the *Chrysanthemum leucanthemum*, or Dog Daisy; the *Chrysanthemum uliginosum*, or Hungarian Dog Daisy; the Swan River Daisy (*Brachycome iberidifolia*); and the Paris Daisies, or Marguerites. All these, and several other composite or asteræceous plants, are popularly called Daisies at times; and nearly the whole of them, and especially the Pyrethrums, single and double, the annual Chrysanthemums, such as *coronatum*, *tricolorum*, and *carinatum*—the last two being probably the same species—are well worthy of cultivation. But it is not of either of these that we would now write, but of the common Garden Daisy, *Bellis perennis hortensis*, the common parent of all our garden Daisies. This is evidently a sport from the common Daisy of the meads, that variegates their verdure with stars of light. When or where the Double Daisy lost its golden heart, or eye rather, and got mountains of thread-like petals piled up over it to hide its original whereabouts under a semisphere of red, white, or mixed colours, history says not. Certain it is that the Daisy took to doubling at a very early stage. The "eyes" of Daisies in the green meads are often richly furnished with ruddy lashes; and the Daisies are always learning the art of doubling, as well as colouring. Culture and selection also strengthen and fix the tendency.

This process of "doubling" is in fact very curious, and a comparison of the Daisy with the flower next on our list will perhaps awaken in the reader, better than most other comparisons, an interest in acquiring some knowledge of the essential nature of that extraordinary variety in the forms of flowers, which will be dealt with in due course.

It is manifest that every flower of the Forget-me-not is a *single* flower. To most people who have no knowledge of botany, and have never made any examination for themselves, the flower of a field Daisy may appear the same. But upon pulling off one by one what are supposed to be the petals, it will be found that each of these is a complete tiny flower, a tubular corolla enclosing the sexual organs, and one edge or side only of the tube being lengthened out like a tongue to form the supposed petal (Fig. 1, A B). Picking these away till all are removed, the centre of the Daisy is seen to be composed of similar tiny flowers, except that one edge of these is *not* prolonged into an apparent petal (Fig. 1, C). The outermost, tongue-shaped flowers are called ray-florets, and the central ones the disc-florets. So much for the common Daisy of the fields. And now the "doubling" of the Daisy, so far as regards the usual and best-known garden form, simply consists in these central or disc-flowers *also* developing one side of their corolla into petal-like prolongations like those of the ray. The effect of this is, of course, to fill up the centre also with apparent petals, the golden "eye" being now buried among these. But, strange to say, there is another method of "doubling," seen in another very common form of Double Daisy—the "Quill Daisy." In this form the above process is precisely reversed; it is now the central florets which are larger and more brightly coloured than usual, while the outer or ray-florets, instead of being tongue-shaped, have become all tubular, like the central ones.

This simple example teaches us at once in what

various ways Nature may go to work, aided by man, to perform the task of "doubling" a flower; and at the very start we learn, from one of the simplest examples, how much light even a very little study can throw upon the nature and development of our garden flowers.

Still, it is slow work converting the Daisy of the field into those of the garden; and as so many good garden Daisies already exist, and seeds of these produce a fair percentage of doubles, and as almost every separate atom of a Daisy root-stock can be converted into a separate plant, it is hardly worth while hieing back to the Daisy of the field in search of either newer or better garden varieties.

The Daisy has been much improved of late years, the German nurserymen especially having directed much attention to it; some of them offer as many as from twenty-five to thirty named varieties. In this country, the varieties of Daisy are less numerous, still the red and white may be had in many strains, varied in regard to size and colour. For the whites are not all equally white, while the colour of the reds ranges from soft red to crimson. Pink Beauty is one of the best pink Daisies, while Victoria is one of the largest and most striking of all the red-and-white mottled varieties. Rob Roy is one of the most brilliant of all red Daisies; while *B. perennis aucubæfolia* well deserves its name, being almost as richly variegated with gold as the old-fashioned well-known showy shrub, *Aucuba Japonica*. This beautiful variety has crimson flowers, but it seldom blooms so freely as the plain-leaved varieties, and the leaves become more richly variegated when the flowers are picked off; and this, in fact, is the most effective way of cultivating this interesting variety of Daisy.

But the most singular and beautiful of all Daisies remains to be noted. This is popularly known as the Hen and Chickens Daisy, and is known botanically as the *B. perennis prolifica*, from the fact that from the base of the flower, or calyx, other flowers on short stems are produced, the general effect being somewhat like the spokes of a wheel proceeding from the nave; each spoke, however, at its furthest point from the centre, being finished off with a tiny Daisy, as shown in the illustration. Hence also the appropriateness of the name, Hen and Chickens. The Hen, or large Daisy, and the Chickens are in this variety generally of unequal sizes (see illustration), distributed at tolerably equal distances from the calyx all round. It is very seldom indeed that any other variety or species of Daisy manifests any tendency to produce "chickens" in this way; neither is this interesting feature reproduced from seeds; nor can it be developed by high culture, though it may be lost and disappear for lack of care and attention.

The most common variety of the Hen and Chickens Daisy is striped red-and-white. But there is also said to be a red and a white strain, although the latter is rare. This proliferous variety is the very choicest of Daisies, and from a botanical point of view is one of the most interesting plants in cultivation.

Culture.—The culture of the Daisy is of the simplest kind, and half a dozen or a dozen plants may be grown on a square foot of ground. It is, therefore, one of the very best plants for small gardens. It thrives well either as an edging around small beds or borders, or in single patches or groups. Beds are also often filled with them, and if small they are most striking in masses of one colour. Larger beds may be mixed with the different colours, or with other hardy flowers of similar height, such as the dwarf *Aubrietia*, *Arabis*, or Forget-me-nots. No garden, however small, should be without its patch or its beds, or window box, if there is no other place for Daisies, and in large gardens there cannot well be too many of them. Few plants can match them in long and continuous blooming, or in rich and telling effects. To have them at their best they should be partially divided every year, immediately after they have finished blooming. The time varies, according to treatment, season, and locality. As a rule, Daisies flower from April to June, or even July. They will thrive in almost any soil; but light, rather rich soil suits them best. Their greatest enemies are slugs and shade. Overrun with larger and coarser plants in the spring and summer, they simply perish; and all the sooner as the shade shelters the slugs, and assists them in hastening through their work of destruction. The ground also gets Daisy-sick, partly perhaps from the rapid growth and enlargement of the root-stock, and also probably from the enormous number of flowers produced in succession; hence the importance of frequent division of root-stock and annual autumnal planting in flowering quarters.

The Daisy is, perhaps, the most divisible plant in the garden. Each separate branchlet may be removed with its modicum of root, and every such morsel of Daisy will form a plant. A small space in an open border, naturally light, rich, and partially shaded, is the best place in which to plant divided Daisies about midsummer. It is a good plan to dibble the plantlets in pretty firmly. Water them home, and see that the plants never lack water during the season; for though the Daisy enjoys the sun when in bloom, it grows faster in partial shade, and with its roots well watered during the droughts of dry summer or autumnal weather. If allowed to become parched, red spider attacks them, and they do but little good.

For early spring flowering, Daisies thus treated

and grown should be carefully removed to their blooming quarters in October or November. Where they are wanted to bloom later they may be removed in the spring. Those who have only grown a few Daisies in tiny beds or borders, should re-divide and change their ground every second year at the longest. A spadeful or two of fresh compost may be dug into a fresh place, the Daisy patch lifted, divided, and re-planted, and thus a splendid spread of Daisy bloom be obtained every year. Nothing can well be more simple than this mode of Daisy culture, and nothing more effectual.

Unless with the object of raising new varieties, it is hardly worth while to raise Daisies from seeds. Sow on a sheltered, partly-shaded bed or border in the open air as soon as ripe, water in dry weather, and keep clear of weeds. As soon as the plants are sufficiently large to handle, prick them out in beds or borders, or in boxes, three inches apart, and leave the Daisies in these till they bloom. Throw out the worthless ones, and plant out in the garden all those that may prove different to or improvements upon existing varieties.

Hen and Chickens Daisy.

Those who do not possess a garden may grow Daisies in pots, either in their yards, window-sills, or other places where a six-inch pot can be placed. Any of these will grow a Daisy plant that will almost hide the surface of the pot with its generous profusion of bloom. Daisies in pots may also be placed inside sunny windows in the early spring, and thus be forced gently into flower at least a month, six weeks, or even two months before they will flower in the open, thereby anticipating to that extent the brightness and beauty of the spring.

Some who love other plants, such as choice bulbs, Pinks, Carnations, &c., more than Daisies, may even use the latter as decoys to entice any slugs, wireworms, and other vermin from them. This is said to be effective, but is very far from being complimentary to the Daisies, which deserve a better fate than that of being converted into vermin-traps for other plants.

The Forget-me-not.—Next to Daisies, this, if better known, would probably be the most popular of all garden plants. Not a few, however, imagine that there is but one Forget-me-not, the one named through the romantic tragic legend that cost the lover his life, and riveted the name to the plant, as he faintly and finally uttered it before he sank to rise no more. But this, of course, is a mistake. There are a great many varieties of Forget-me-nots grown in gardens, and it also happens that the particular one (*Myosotis palustris*) being an *aquatic* is seldom found there. As it is however one of the most beautiful, in fact the most strikingly romantic in fiction, it should find a place wherever a little water or a damp border can be found, for this is really the true Forget-me-not.

Among the most useful of the other Forget-me-nots for the garden is the dwarf Alpine Forget-me-not (*Myosotis rupicola*), found in Scotland. This seldom grows more than three inches high. The flowers are of the richest azure-blue, of a large size, and the foliage is also rather large for the size of the plant.

M. alpestris, or Alpine Forget-me-not, is a very rich-coloured dwarf, rather taller, but otherwise resembling, if not identical with, the Rock Forget-me-not of Scotland, already named (*M. rupicola*).

M. azorica is a much darker species, introduced from the Azores in 1846. This is one of the earliest Forget-me-nots, and, like all the rest of the early-flowering section, it very often blooms in April, and has a large percentage of rose-tinted bloom. There

is a superior and more azure-coloured variety of this species (*M. Azorica cælestina*), in which nearly all the flowers are blue.

M. Impératrice Elisabeth, a fine, robust, high-coloured variety, is said to be a hybrid between the fine species from the Azores and the Rock Forget-me-not of Scotland (*M. alpestris*). The Wood Forget-me-not (*M. sylvatica*, or *sylvestris*) is also among the most useful plants for beds and borders; and there is a pure white variety of this which is very useful.

The best of all the Forget-me-nots for the garden still, however, remains to be noticed; this is *Myosotis dissitiflora*, closely related to, if not identical with, the *M. montana*. Its name is derived from the looseness of the flowers on the stems, and their distance from each other, which gives more room for their individual expansion; and hence this is at once the largest-flowering and the most beautiful of all the Forget-me-nots. In the early season, when the cold nipping March winds are about, the flowers of this fine species are very much suffused with rose; but as the season advances this changes, and all the flowers become of the softest shade of blue. There is a larger variety of this species, and also a pure white variety. The larger, or major sort, is almost double the size of the common strain, and hardly stands the weather so well on that account. This is one of the earliest and best of all the Forget-me-nots; in fact, it is so pre-eminently good that in not a few gardens it has superseded all others, and is grown by thousands and tens of thousands for spring gardening. In mild seasons it flowers with the Fair Maids of February, the Snowdrops, at that early season. In most it flowers through March, April, and May, and with a little care as to time of sowing and propagation, this lovely Forget-me-not may be had in flower nearly all the year round.

Culture.—The species and varieties here specified are perfectly hardy, though it is found that young and rather small plants stand severe weather much better than larger ones. The reason seems to be that the Forget-me-nots suffer more from wet on their crowns than from cold. The large plants allow the wet to accumulate and remain, and the frost bites them hard in consequence. Some also contend that seedlings are more hardy than plants raised from root-division or cuttings; but this is hardly likely; however, as most of the *Myosotis*, and especially the *dissitiflora*, come quite true from seed, it is just as well to increase and multiply it in this way. Sow it in June or July in a sheltered, shady border; before winter the plants will have reached a nice size for flowering next spring. As the seeds of all the Forget-me-nots are exceptionally small, it is impossible to sow them too thinly or cover them too lightly. The soil should also be light and rich, though almost any soil will do for these Forget-me-nots, provided it is neither too stiff nor too dry.

When once grown in any garden, the Forget-me-nots are almost sure to reproduce themselves from seed with sufficient freedom to render unnecessary any systematic saving of the seeds. Chance seedlings will not only abound, but they will generally prove more robust than any other.

Another very simple way of increasing Forget-me-nots is to pull the plants to pieces immediately after flowering, and plant each little branchlet that has a rootlet as an independent plant. If this is done carefully, the plants placed in fairly good soil, and not allowed to get dry during the season, they will bear a second division of stools by about the end of September, and then have grown into nice flowering tufts before the end of the flowering season. Moist and partially shaded beds or borders are best for all the Forget-me-nots, though several species grow on mountains, and others of the more dwarf species seem to live on almost barren rocks; yet the roots find moisture in the crevices, and no Forget-me-nots in gardens should be allowed to become once really dry, or to flag in the least from drought.

But the fact is, these plants are so easily grown and propagated that no small garden should be without them. The common treatment of the most common flowers will suit these admirably, or if a place with rather more shade and moisture than another can be found, plant these full of Forget-me-nots. Unless the seeds sow themselves, scatter a few over beds and borders at times, and simply and very slightly rake them in; also now and then, and at any dripping time during the season, lift, divide, and replant a few Forget-me-nots, and by such simple means provide a constant succession of their lovely flowers in the garden.

Forget-me-nots look well among ferns, and on rockeries among Alpine plants. Some of the species, such as *alpestris*, *azorica*, and *dissitiflora*, do remarkably well clothing crumbling walls and climbing ruins, the plants seeding themselves, and also agreeing well with the common yellow single Wallflowers, and the best of all creeping plants for such positions —*Linaria Cymbalaria*. Forget-me-nots, especially the *M. dissitiflora*, also flower admirably in pots. Place a nice bushy plant in a sunny window in January; it will be in bloom in February, and keep on blooming right up to May, provided always it is carefully watered and liberally fed. By potting up at intervals of a month or so a few plants of the lovely Forget-me-nots, and placing them in the windows, the rooms would be lightened up with their unique beauty, and the dwellers in the house be brightened and cheered by their presence throughout the year.

GREEN-HOUSE PLANTS.

By William Hugh Gower.

INTRODUCTORY.

ALTHOUGH the plants which are treated upon under this heading are for the most part natives of warm parts of the globe, they require very little artificial heat in this country; indeed, the majority thrive during the winter months in a temperature a few degrees only above the freezing-point. This fact teaches us that even in tropical countries there are cool regions; and therefore for the proper treatment of a plant it is not sufficient to know that it is a native of the East Indies, or South America, but its particular *place* in either of these countries should be ascertained; whether it grew in swamps or upon rocks, &c, and the elevation above the level of the sea; because there are such wonderful changes in the atmosphere and temperature of the plains, and the summits of the mountains. Seeing that plants naturally are subjected to such different atmospheric conditions, their various requirements under cultivation must be studied and ministered to in order to maintain them in health and develop their beauties.

Independently of the importance of the vegetable world in an economic and commercial point of view, the study of plants is full of delightful associations; their wonderful forms and gorgeous beauty never fail to secure the admiration, not only of the civilised world, but even of the naked savage. But fashion has to a great extent ruled the garden; and the rage for quick-growing soft-wooded plants has elbowed too many grand old plants out of our green-houses, simply because they had become old-fashioned and "slow."

The object of the green-house is to give *shelter* to those plants which, although they require but little artificial heat, are yet not sufficiently hardy to withstand the vicissitudes of our climate during the winter unprotected. By the assistance of such a structure we are enabled to maintain a succession of bloom all through the dull and dreary months of winter, and that too without much expense in the cost of fuel, which in these days is usually a serious item in garden expenses. Amongst special winter-blooming plants, some of the most showy and decorative are the Australian Acacias, which form gorgeous masses of yellow blooms in various shades. Not less beautiful, but totally different, are the Epacris, from the same country, with their beautiful racemes of waxy bell-like flowers, which are equally useful for bouquets, button-holes, or the decoration of a lady's hair for ball or evening party. The Heath family (*Erica*) likewise contribute their quota to the winter decoration of the green-house, as also do the large families of Camellia and Azalea; these latter, indeed, may be looked upon as the two most essential genera yet in cultivation for green-house decoration.

A few words upon the structure of the green-house will be necessary even here, though the subject is to be separately treated. In the old times, plant-houses were nearly always built one-sided, or what is commonly known as "lean-to" houses; and many good plants have been and are grown at the present day in such buildings. They, however, are neither so good for the cultivation of plants, or present such a good appearance, as the modern span-roof house; because, in the lean-to house, unless the plants are frequently turned round, they draw towards the light and *themselves* become one-sided, which renders the plant quite unfit for drawing-room or dinner-table decoration, or indeed for any other position but the place it has grown in.

The two chief points to study in the cultivation of green-house plants are full exposure to the light, and abundance of fresh air.

Abelia, a genus of pretty plants belonging to the Honeysuckle family (*Caprifoliaceæ*), almost hardy in warm localities, and anywhere admirably adapted for a cool greenhouse. They are easily propagated by cuttings in summer, inserted in sandy soil, and kept close until they are rooted.

A. floribunda is perhaps the most beautiful species in the family; it has small opposite, oblong, evergreen leaves. It grows to a height of three feet, and is well adapted for covering trellis-work. The flowers are freely produced during the early spring months, and are tubular and pendent, some two inches long, of a soft rose-colour. Mexico, 1842.

A. rupestris. — This species has opposite, oblong, hairy, deciduous leaves. It attains a height of from four to five feet. The flowers are white and red, sweet-scented, produced in pairs at the ends of the branches. August and September. China, 1844.

A. triflora, leaves ovate lanceolate, evergreen and twiggy, growing to about five feet in height. Flowers arranged in threes, and produced in corymbs at the ends of the branches, pale yellow, suffused with a tinge of pink. July and August. Northern India, 1847.

A. uniflora is so like *rupestris* that both are not needed.

Abutilon.—A genus of malvaceous plants, many of which are highly ornamental. They have somewhat palmately divided leaves, and produce large bell-shaped flowers, which, being supported upon long slender foot-stalks, give them a pendulous or drooping habit. Besides the species which have been introduced, the genus has been taken in hand by the cross-breeders, and some very beautiful varieties have been obtained. The flowers of Abutilons are extremely useful, either for button-hole flowers, bouquet-making, or the decoration of apartments; and when left upon the plants in the green-house they form very attractive objects. Many varieties

of Abutilons are strong growers, and therefore are admirably adapted for training upon pillars or rafters. They should be potted in loam and peat, or leaf-mould, with the addition of a little sharp sand. The following are some of the most desirable species and varieties:—

A. Boule de Neige.—Pure white.
A. striatum.—Orange, beautifully veined with crimson.
A. Boule d'Or.—Large and globular, rich golden-yellow.
A. Caroline.—Light pink, veined with rose.
A. Fire King.—Flowers in pairs, bright orange-scarlet.
A. insigne.—Rich crimson and white.
A. Duc de Malakoff.—Flowers very large, bright orange.
A. Seraph.—Pure white, large and fine.
A. robustum.—Rose, veined with reddish-purple.
A. Trophy.—Pale yellow, streaked with reddish-carmine.
A. Verona.—Rosy-pink, streaked with reddish-crimson.
A. vexillarium.—A dwarf species; flowers red and yellow; there is also a variegated form of this plant. Now named *A. megapotamicum.*

Acacia.—This is a family of handsome shrubs, some, indeed, attaining the dimensions of large trees, belonging to the order *Leguminosæ.* They are widely distributed over the warmer parts of the globe; the greater number of the species, however, are natives of Australia, where they are popularly known by the name of "Wattle-trees." Independently of their beauty, the genus claims our attention from a commercial point of view, as some of the species yield valuable drugs, &c. "Gum Arabic" is the produce of *A. vera, A. Arabica, A. Verek,* and other allied kinds. "Gum Senegal" and the drug called "Catechu" are also obtained from various species of *Acacia.* Again, many yield a valuable tanning material largely used in the preparation of leather, whilst from the seeds of some kinds the Indians of South America produce an intoxicating spirit.

In many of the species the leaves are tripinnate, and give the plants a handsome plume-like appearance. The majority of the kinds produce an abundance of beautiful flowers during the spring and early summer months, which entitles them to take first rank amongst green-house shrubs.

The species here enumerated as being remarkable for the beauty of their flowers are amongst the most desirable for green-house and conservatory decoration, and all are natives of various parts of Australia.

It is remarkable that very many of the Australian Acacias do not develop their true leaves, but, instead, have their leaf-stalks flattened out and elongated into leaf-like shape; these are called "phyllodes," and are arranged edgewise upon the stems and branches. These "phyllodes" not only take on the appearance of leaves, but also perform the same functions.

The roots of Acacias are remarkable for giving off a strong disagreeable odour, somewhat resembling that of garlic. They are plants of very easy culture and of strong constitutions. For soil they prefer about equal parts of loam and peat, or loam and leaf-mould, with a small quantity of sand added to keep the mould open and porous. Acacias require an abundant supply of water, and the pots in which they are grown should be well drained, for bad drainage is as inimical to plant as to animal life.

During the summer months, which will be after the flowers are past, these plants will thrive best in the open air, care being taken to keep worms from entering the pots, and proper supports being used in order to prevent injury from strong winds.

Acacias are not much troubled with insect enemies, although sometimes they become infested with a small white scale, which, if allowed to increase without check, will not only disfigure the plant, but speedily affect the health of the victim. Whenever this insect makes its appearance, the plants should be laid down, and have a solution of soft-soap and hot water applied with vigour from the syringe. A little paraffin oil may be mixed with the soap with advantage, but care must be exercised in its application, and by no means should it be allowed to reach the roots.

Propagation is effected both by cuttings and by seeds.

A. armata.—This charming species is, from its close and compact habit, well adapted for cultivation in small pots. The leaves, or phyllodes, are entire, somewhat ovate in shape, and intense deep green, which forms a fine contrast to its rich golden balls of flowers. With age the plant attains a height of eight to ten feet, but young plants one foot high will flower very freely. (Introduced from New South Wales, 1803.)

A. argyrophylla.—This is a very handsome shrub, even when not in bloom. The phyllodes, or false leaves, are large, obovate, or narrowing from the base upwards, and clothed with a silvery-grey tomentum. Its globular heads of deep yellow flowers are produced in the greatest profusion during the spring months.

A. cærulescens.—A pretty shrub, with bluish obovate leaves, and globose heads of rich yellow. It flowers in the spring months.

A. cochlearis.—The flowers of this species are bright yellow and sweet-scented. It blooms in mid-winter, which is an additional attraction.

A. cultriformis.—One of the most beautiful species. The name implies that the leaves, or phyllodes, resemble in form the blade of a knife, but it is a very short blade. They are bluish-green in colour, and terminate in a sharp bristle-like point. Flowers

A. floribunda.—Phyllodes three to six inches long, linear, tapering at each end, light green. As its name implies, very floriferous. Spikes long, bearing a profusion of its rich yellow flowers during May and June.

ABUTILONS.

Fire King. Vexillarium (variegated).

are produced in long racemes in great profusion, globose, and rich yellow. Spring and early summer.

A. Drummondii.—This forms a dense and compact shrub, and if only one species of *Acacia* can be accommodated in a collection, this should be the one selected. The leaves are pinnate, and dark green; flowers, straw-colour, and borne on long cylindrical spikes in great abundance. Spring and early summer.

A. grandis.—This and *A. grandiflora* are very similar plants, if not one and the same species. It is a dwarf, compact, twiggy plant, with small dark green pinnate leaves. The globular heads of yellow flowers are furnished with long petioles, or footstalks, and thus the whole plant presents a mass of golden-yellow bloom. One of the very best kinds. Spring months.

A. graveolens.—A fine, bold-growing plant, with

lanceolate phyllodes, upwards of four inches long, tapering at each end, and bright green. The globular heads of flower are usually produced in pairs from the axils of the leaves, bright yellow, and sweet-scented. This is a very effective kind, the shoots being clothed with racemes of bloom twelve to eighteen inches in length. Spring months.

A. lineata.—Phyllodes linear, lanceolate, and dark green. The globose heads of flower are bright yellow, on long foot-stalks; a very showy species, flowering in the early spring months.

green, furnished with a pair of long sharp spines at the base; flowers globose, on long foot-stalks, golden-yellow. Spring and early summer.

A. platyptera, the Winged Acacia, so called on account of the broad leafy wing, which extends on both sides of the stem; flowers produced upon long spikes, rich deep yellow, very showy. March and May.

A. ovata.—A beautiful dwarf plant; the phyllodes are small, closely set, ovate, and dark green; the flowers are bright golden-yellow, upon long foot-stalks, and are freely produced. Spring months.

Acacia Riceana.

A. longifolia.—A fine bold-growing kind, with lanceolate dark green phyllodes; the flowers are pale yellow, on long loose spikes. April and May.

A. lophantha.—This species is not remarkable for its beautiful blooms: indeed, although they are produced on fair-sized racemes, the colour is such a pale washed-out shade of yellow that they are by no means attractive; as an ornamental foliage plant, however, it is quite charming. The leaves are broad, pinnated, and divided into numerous small segments, which are dark green; when grown on a single stem it is most effective, and in its young state is admirably adapted for the decoration of a dinner-table. Now named *Albizzia lophantha.*

A. paradoxa.—Phyllodes oblong lanceolate, bright

A. Riceana.—This species makes long pendent branches, which render it very suitable for training on a pillar or roof of a conservatory. We are told that "it was discovered by Robert Brown growing like a weeping willow upon the banks of the tributaries of the river Derwent in Tasmania;" and certainly when trained to a roof, with its pendent branches loaded with its globose heads of golden-yellow flower, it is a picture never to be forgotten. March to June.

A. rotundifolia resembles in general appearance *A. ovata;* it is, however, larger in all its parts; phyllodes obliquely rounded, dark green; flowers globose on long foot-stalks, deep yellow. Spring and early summer.

A. siculæformis.—Phyllodes long and narrow, terminating with a sharp spine; deep green flowers on very long slender foot-stalks, golden-yellow; a very distinct plant, and an abundant bloomer. Spring and early summer.

A. Sophoræ.—A very different plant from the preceding; here the phyllodes are some three inches long, broad, and pale green; the flowers are borne upon cylindrical spikes nearly two inches long, light yellow, very showy. Spring months.

A. undulæfolia.—A beautiful free-blooming species, with oblong ovate phyllodes of a glaucous hue; flowers numerous on long spikes, golden-yellow. Spring and early summer.

A. verticillata.—Phyllodes arranged in whorls broadly linear, with a sharp spine at the apex, intense deep green; flowers dense, on long cylindrical spikes, pale yellow; a somewhat pendent plant, and one well adapted for training upon pillars and rafters. Spring months.

A. vestita.—This handsome plant is a dense close grower and also a profuse bloomer; the phyllodes are small, somewhat ovate, and slightly downy; flowers globose, on long spikes, pale yellow. Spring and early summer.

ADENANDRA SPECIOSA.

Acrophyllum.—This genus contains one species only, a native of Tasmania. It belongs to the order Cunoniaceæ, and although a somewhat difficult plant to cultivate, it well repays any labour bestowed upon it. The plant in question, known as *Acrophyllum venosum*, is a slender erect-growing shrub, the leaves sessile, oblong cordate, and coarsely serrated, arranged three in a whorl round the stem, and bronze-green in colour. The flowers are individually small, but being arranged in great numbers round the stems on the previous year's growth, they present a very beautiful appearance, which makes the plant well worthy of cultivation. It blooms during the spring and early summer months. The soil should be peat and sand only, and the drainage of the pots must be perfect, or failure is sure to ensue. Introduced 1836.

Adenandra.—A small genus of plants, all natives of the Cape of Good Hope. The leaves of this and various other allied genera are much esteemed by the Hottentots to anoint their bodies, though the perfume emitted is not welcome to European ideas.

The soil they thrive in is sandy peat, to which may be added with advantage a small portion of light loam. Adenandras are very showy, useful for house decoration or exhibition purposes, and deserve more attention than plant-growers give them. After flowering, the shoots must be cut back, and the plants subjected to a somewhat closer atmosphere than usual. This mode of treatment will induce them to break back, and produce a much better furnished specimen than can otherwise be obtained. There are several species, those here noticed being the most desirable.

A. fragrans.—A dense-growing plant, clothed with an abundance of small, oblong, glandular, dark green leaves; the flowers, which are produced in May and June, are terminal on the shoots, star-shaped, rosy-pink in colour, and highly scented. Cape of Good Hope, 1812.

A. speciosa.—A more robust-growing plant than the previously-named species, having larger leaves, which are furnished with a small marginal fringe;

flowers bright pink, produced in terminal umbels during April and May. Cape of Good Hope, 1789.

A. uniflora.—Similar in habit to *speciosa;* the flowers, however, are solitary upon the points of the shoots, white inside, outside stained with pink. April and May. Cape of Good Hope, 1775.

Agapanthus.—These are old-fashioned flowers, and unfortunately much neglected by plant-growers. They require so little care that any one can grow them. Although considered green-house plants, they are really nearly hardy, and can be grown into good specimens by those amateurs who do not revel in the luxury of a glass-house. The plants make very stout roots, and therefore require plenty of pot-room. Drain the pots well, and pot into good strong loam. During summer they stand in the open air, and in winter any shed or out-house will be sufficient protection, providing the frost does not reach them. They enjoy an abundant supply of water. Agapanthus means lovely flower, and it is popularly known as the Blue African Lily. The leaves are long and narrow, whilst the flowers are borne in large umbels, supported on tall slender stems.

AGAPANTHUS UMBELLATUS.

A. umbellatus.—A very old inhabitant of our gardens, and really a charming plant; umbels of flowers large, bright blue. July and August. Cape of Good Hope, 1692.

A. umbellatus albiflorus.—A smaller-growing form of the species, which produces white flowers; it is of more recent introduction.

A. umbellatus maximus.—A bold and robust grower, producing larger leaves and flowers than the other type, but scarcely so free-flowering.

A. umbellatus variegatus.—A somewhat small-growing kind, having the leaves all striped with white, and although variegated leaves are extremely popular, this is the least desirable form of the species.

Agathæa. — The name comes from *agathos*, "pleasant," and refers to the extreme beauty of the flowers. It belongs to the natural order *Compositæ*, and is easily increased by cuttings.

A. cælestis, popularly known as the blue Marguerite, is a showy plant, one that is almost always in bloom. Cape of Good Hope. 1753.

Agave.—A family of plants popularly, but erroneously, known as "American Aloes," the true "Aloe" being quite distinct from these in every respect. The leaves are thick and fleshy, and armed at the points and margins with stout sharp spines. They contain a great quantity of immensely strong fibre. At one time it was hoped this might become of commercial importance; but, although the yield of fibre was large, the plants were so slow in growth that the supply was soon exhausted. The Mexicans make, from very ancient days, an intoxicating drink called "pulque" from the juice of *A. Americana.*

It is, however, as ornaments to our garden we have to treat of Agaves here, and certainly they are unequalled as bold and massive plants for the decoration of green-house or conservatory. They form noble ornaments for surmounting flights of steps on terraces during the summer months; and, if space is limited in the green-house during winter, these plants may be kept with ease and safety in a shed or stable, provided they are quite dry and nearly all light is

excluded. Agaves have a special claim on small amateurs, whose business pursuits leave them but little leisure to attend to plants, for as the leaves are thick and fleshy, they do not feel the want of water or the sudden change of temperature in the manner that other plants would, consequently they may be left to

specting Agaves, viz., "that they flower only once in a century." This may be accepted as truth, but it must not be assumed that it takes a hundred years for them to arrive at a flowering state, although they are extremely long-lived, and instances are recorded of plants of the larger kinds being a century in cul-

AGAVE AMERICANA.

care for themselves with greater impunity. Although the large-growing species, *A. Americana*, is quoted as the representative of this genus, those which are limited to space can be easily accommodated, for the family is a very large one, and some of the smaller-growing kinds form exquisite specimens, never exceeding one foot in diameter, or even less.

A few words must be devoted to the old saying re-

tivation without producing flowers. But when they do bloom, the spike springs from the crown of the plant, and, after seeds are perfected, death ensues; so that the plant only flowers once in its life, and it would be equally true to say that it flowers only once in a thousand years. This latter statement, however, requires a little explanation, inasmuch as it is open to contradiction. The genus *Agave* belongs

to the natural order *Amaryllidaceæ*, and may be divided into two sections—one of which produces a ramose flower-scape thirty or forty feet high, resembling a large candelabrum, of which *A. Americana* gives an apt illustration; the second section, of which *A. filifera* may be taken as a type, produces a simple scape only, on which the flowers are usually densely crowded towards the upper part. In the case of the first section, death invariably ensues after flowering; but in the other, plants do sometimes survive the flowering state, when the spike is produced from a lateral and not the terminal bud. The American Agave appears to have first flowered in England about the year 1729. It had been reported to have flowered at an earlier date, but it would appear that these reports were incorrect, and refer to smaller species which had been introduced under the name of "American Aloes;" and instances of their flowering are still so rare that when such a fact is announced it never fails to attract a large concourse of visitors.

AGAVE FILIFERA. A, flower; B, end of leaf.

The cultivation of Agaves is extremely simple; in fact, no class of plants can be managed so easily. The first essential is thorough drainage, without which these plants will soon take on a sickly yellow hue and rapidly die; but drain the pots well, use stiff yellow loam for the large-growing kinds, and a rather lighter loam for the less robust, and that is all that is required in the way of soil.

During summer expose them to the full influence of the sun without any shade, and give them an abundant supply of water; during winter, however, very little will be required, but they should not be allowed to dry sufficiently to shrivel their leaves. If Agaves have to be accommodated in a mixed collection of green-house plants, they should during winter be placed at the driest end of the house, and any damp or mildew kept from them.

Selections.—The following are amongst the most attractive species, divided into two sections, large and small-growing, so that our readers may select for themselves according to the space at their command:—

I.—Large-growing Kinds.

A. Americana.
A. ,, medio-picta
A. ,, striata.
A. ,, variegata.
A. amœna.
A. Celsiana.
A. coccinea.
A. densiflora.
A. ferox.
A. Hookeriana.
A. Humboldtiana.
A. Jacobiana.
A. Jacquiniana.
A. Koratto.
A. Kellockii.
A. macrocantha.
A. Maximilliana.
A. mitræformis.
A. potatorum.
A. pugioniformis.
A. Salmiana.
A. univittata.
A. Xalapensis.
A. Xylacantha.

II.—Small-growing Kinds.

A. Applanata.
A. Besseriana.
A. ,, candida.
A. Corderoyi.
A. cuspidata.
A. de Smetiana.
A. ensiformis.
A. filifera.
A. Galeotii.
A. gemmiflora.
A. Ghiesbreghtii.
A. horrida.
A. hystrix.
A. ,, lævior
A. Leopoldii.
A. Poselgerii.
A. Regelii.
A. scabra.
A. schidigera.
A. Seemani.
A. Verschaffeltii.
A. Warreliana.

THE ROSE AND ITS CULTURE.

By D. T. Fish.

BRIAR AND OTHER STOCKS FOR ROSES.

TO prevent the possibility of mistake, the term "briar" throughout this chapter is used in a technical sense, and may be said briefly to include *all wild Roses* fit for stocks, with the single and most important exception of the Sweet-briar, which is not fit for the purpose, or rather makes such a bad stock as not to be recommended for use. More particularly, however, the term "briar" here is employed to denote one species of Rose, the Dog-rose, or *Rosa canina*, with its five or six varieties. This is undoubtedly the best of all British or European wild Roses for stocks, though on the Continent several others are used, notably *Rosa villosa*, or any other free-growing wilding of the woods.

The Continental demand for very tall stocks renders a wider selection necessary, and it is no uncommon thing in France to find standard or weeping Roses worked on stems from ten to fifteen feet high. The French seem to have been the first to introduce the fashion of standards, and they probably excel all others in the matter of height. Their tall standards have been and still are popular, and have created a considerable trade as well as a rage for imitation in other countries. They also treat them differently, and manage to convert them into Rose-trees sooner than most others. Instead of waiting for the development of lateral shoots to receive buds at midsummer (see Budding, in the next chapter upon Propagating Roses) they place from one to a dozen buds on the upper portion of the main stem in the spring. These generally take, and the stock becomes a Rose before the English ones are fit to bud.

Briar Stocks.—The only Rose stocks known or thought of a few years since were those tall wildings of our woods and hedge-rows. They were valued more for giving elevation to Roses, than as modes of rapidly increasing their numbers. A few were collected in the early winter, planted any time from November to February, budded the succeeding June—thus simply finishing the matter of Rose stocks for the year.

Now, briar-hunting, carriage, planting, and culture have risen to the dignity of a trade. Those not conversant with the magnitude of the Rose industry can have no idea of the thousands and tens of thousands collected and planted every year. Nursery gardens have been crowded, and the surplus stock of briars have overflown into fields, and furnished not a few farms. And still the briar trade grows. Woods as well as hedge-rows are scoured every year all over the country, and few briars of any height or merit escape the keen eyes and sharp mattocks of the briar-men. On some lines of rail, truck-loads of briars are almost as plentiful in November and December as coals. And yet the more collected the faster they seem to grow, and next year, and again the next, the briar appears in larger quantity than ever.

What may be called the natural supply of wilding stocks has hitherto satisfied the apparently insatiable demand for standard Roses, that is, such as are mounted on foreign stilts or stocks of heights varying from eighteen inches to seven feet. The majority of these standards, however, are between three and four feet high.

Many attempts have been made of late years to laugh these tall Roses down. But it seems they only increase the faster. They appear to thrive on ridicule, and only to "take in" additional fields or farms, the more keen and sharp the ridicule becomes.

Doubtless standard briars fill a useful place in the garden. Being also first in the field, they hold their

own firmly against all comers. Their mere elevation imparts dignity to the Rose which crowns them, and they can be converted into a noble tree-rose within nine months or less of the time of planting.

General Treatment of Standard Briars.—So soon as received trim and plant; if this is impossible, lay in by the heels so soon as received. These briars have very few roots in the proper sense of the word, and the few they have are mostly air or sun-dried or frost-bitten before they reach the cultivator. Hence the greater need of prompt attention and planting.

A thorough and proper pruning of standard briars must precede the planting, and extend to the roots as well as the tops. The former are often represented by large pieces of underground stems (Fig. 6). These may generally be shortened back to within three or four inches of the root-stocks or boles. The tops may also in most cases be shortened back so as to leave the stem tolerably straight (Fig. 7). All snags should also be cut or sawn clean off by the stem. The best implements for this sort of work are a small hand-bill and a handy pruning-saw.

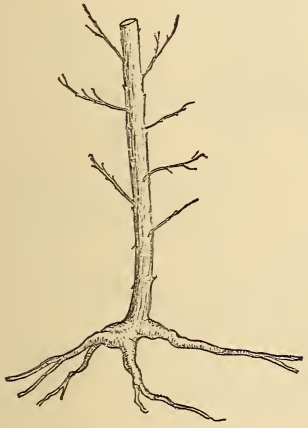


Fig. 6.—Briar in its Natural State as dug up from Hedge-row.

Fig. 7.—Briar with Root and Top Pruned for Planting.

Fig. 8.—Briar with Root and Top grown on towards Buddable Condition.

Best Place for Briar Stocks.—To grow Dog-rose stocks well, the soil should be equal to that recommended for Rose-trees. They have been accustomed to endure hardness on banks and in hedge-rows; but in the budding-grounds they must have something good to feed upon, if they are to form strong foster-mothers for the coming Roses. A nice snug border in the kitchen garden suits them well.

Distance to Plant Standard Briars.—A yard between the rows, and from six inches to a foot from plant to plant, are the usual distances. A better way is to plant two rows, the plants alternately, not opposite, nine inches or a foot apart, and leave a space of four or five feet between the dual rows. This affords greater facility of access for disbudding, budding, and other necessary operations among the stocks.

Firm Planting.—In order to insure this and to dispense with the need of stakes—and, indeed, these are impossible on a large scale—the temptation is strong to plant too deeply. By thrusting the root-stump into the earth a foot or so, and treading the soil firmly around its stem, the standard briar bears the wind with impunity. But on no account should they be planted more than half that depth, treading them in firmly after being filled up. There should always be two to plant briar standards—one to use the spade, and the other to place and hold up the briar until the earth makes it secure. Amateurs who plant a moderate number of briars should stake each one, or run a rail attached to a few tall posts along the line to keep the briars in position, not only when planted, but afterwards when they have formed heads.

Disbudding and the Removal of Suckers.—After planting, nothing more will be required till the spring. So soon as the buds begin to appear, all should be removed but two or three of the most forward and best-placed on the briar standard. As a rule these will be found nearer the top of the briar,

not always, however; and the strongest and best should be left wherever found, the stocks being afterwards headed down to these. All suckers should be followed up to their originating roots, and removed close to the root-stocks. Were this simple plan invariably acted upon, the plague of suckers would be unknown among cultivated Roses.

up of standard briars, multitudes of roots of various sizes are met with. These, if carefully collected, cut into lengths of six inches or a foot, and planted at once, leaving the upper ends an inch or so from the surface, will grow into good stocks for dwarf Roses. The process of forming fresh roots and growing into plants will be much hastened if such

Rosa Brunonii.

Caterpillars, grubs, and other insects will sometimes appear very early, and must be removed or destroyed at once. Thus treated the stocks will speedily grow into condition for budding. That fascinating art will be fully taught in our next chapter, on the Propagation of Roses.

Briar-roots.—These are far from having received the attention they deserve. In the grubbing

roots are placed in warmth for a few weeks before planting. As they take no harm buried in the soil, they might remain thus till February, be laid in a gentle hot-bed all through March, and be either worked in that state and again subjected to heat, or planted out in April, and grown in the open a year or so before being worked.

Briar Cuttings.—These now far exceed in

number and importance the standard briars, while briar-roots as stocks have never been popular. Entering some Rose nurseries towards the end of the year, one's first thought might well be, "They are going into the fire-lighting trade." Huge heaps of small pieces of stick from nine inches to eighteen or more long are scattered about, and

With proper care in the selection, insertion, and after-treatment of the cuttings, the majority of these will root firmly, and the whole may be grafted or budded within one year, or at the most eighteen months or two years, of the time of insertion. Unless in very dry weather in the spring or summer after planting, when a good soaking of water might prove

ROSA CANINA.

little but the sharp sound of the bill-hook is heard as it chops away from morning to night, adding to the size of the heap. These are briar cuttings; and presently after the chopping will come the planting; and acre after acre of these will be planted in closely-crowded rows from eighteen inches to two feet apart, and from six to nine inches between the cuttings. These are generally dug and trod firmly in as the work proceeds, leaving from two to four eyes above ground.

useful, all the attention these cuttings need till they are worked is keeping clear of weeds.

Seedling Briar Stocks.—These are the most formidable rivals to standard briars and briar cuttings that have yet appeared. Were it not for the fact that the seeds vegetate slowly, and come up at irregular intervals over a period of two years, and that the plants in many localities

grow very slowly during their first stages, these seedlings would doubtless soon supersede all other stocks for Roses. As it is, they are multiplying in all directions, and one large grower for sale advertises as the highest recommendation that all the Roses sent out from his firm are worked on the seedling briar. Others are equally enthusiastic in favour of briar cuttings. However, there is little doubt that the seedling briar will continue to be a favourite stock among rosarians.

The supply is virtually unlimited, for few plants seed more profusely than the Dog-rose. With a view, however, of having pure stocks, or strains of seeds, several nurserymen have begun to grow their own seeds. This is important, for in a bundle of seedling briars lately to hand there was a large percentage of Sweet-briar, useless as a stock, and numerous other species of Rose besides that of *Rosa canina*.

Time and Modes of Sowing Briar-seeds.—As to time, so soon as ripe, or in the spring, are the only two seasons, and the first is the best. Nothing is gained—a good deal, the seed itself, may be lost or greatly injured—by being kept till the spring. Rub the seeds out of the hips, mix them with a little dry sand and part them from the chaffy matter that envelops them, and sow at once. This prevents the trouble and risk of drying, and the seeds are safer in the earth than in bags or drawers.

On the Continent it is customary to sow the seeds under glass so soon as gathered, or in February or March. They vegetate much sooner under this extra warmth; and as the season advances the glass may be almost entirely withdrawn. Place it over them, however, next winter, and the following spring line out the plants in drills a foot apart, and two or three inches from plant to plant. After a second season's growth most of them will be fit to graft or bud, and it is said that the French and other Continental seedling briars are almost as large again for their age as the English.

But the seeds may be safely reared in the open air, either sown when gathered, or in the spring after interlayering with sand through the winter. Sow the seeds broadcast in beds, covering with at least two inches of light compost, or in drills from two to three inches apart, and from six inches to fifteen between the rows. Keep free of weeds, and occasionally water in dry weather, not only as a stimulant to growth, but as a preventive of mildew. Some of the finest plants should be thinned out, and placed at wider intervals apart towards the end of the season. As many of the seedlings will be very small, and part of the seeds may not have yet vegetated, the safest way of removing the finest plants to new quarters is to thoroughly soak the seed-beds or rows, or choose a dripping time for the operation. Carefully loosen up beds or rows with a fork, and then draw out all the finest plants. A slight top-dressing and raking smooth afterwards will make the original seed-beds or lines safe, and the partial disturbance and dressing will act as a stimulant to growth.

The plants removed will have their quill-like roots almost as long as the tops (Fig. 9, No. 1). These

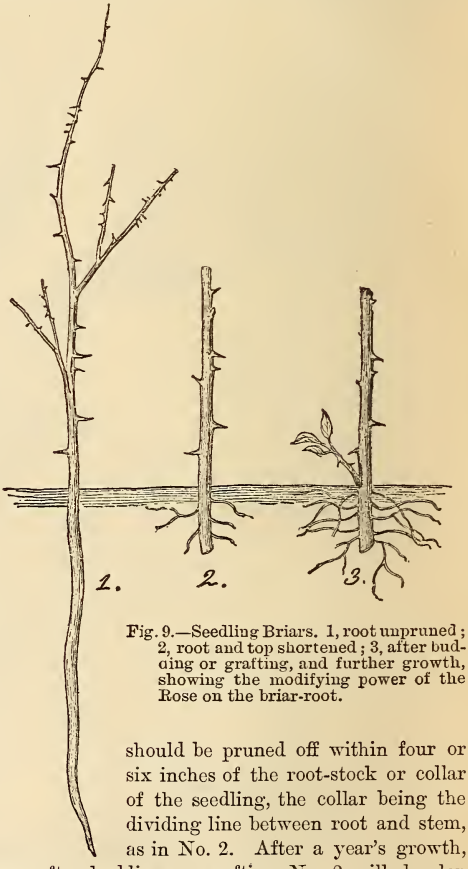


Fig. 9.—Seedling Briars. 1, root unpruned; 2, root and top shortened; 3, after budding or grafting, and further growth, showing the modifying power of the Rose on the briar-root.

should be pruned off within four or six inches of the root-stock or collar of the seedling, the collar being the dividing line between root and stem, as in No. 2. After a year's growth, soon after budding or grafting, No. 2 will develop into a rooted state like No. 3. Plant at once in light rich soil, and should they do well many of these will be fit to graft by the autumn of the second year—the majority when three years old.

These seedling briar stocks, if budded or grafted very low, seem to lose most of the rough, coarse and rambling peculiarity of Dog-rose roots, and form fibrous masses of rootlets more like those formed by Roses on their own roots, the tops thus perhaps dominating the root-form and development of the young foster-mother (Fig. 9, No. 3). Certainly it seems that seedling briars worked early and worked low, almost

on the root-stock itself, lose their potency in the production of suckers. Further still, in confirmation of the change of root-form, and its natural results, it is found that Roses worked early on the seedling briar are more floriferous than those worked on other stocks, not even excepting the briar cutting. Hence the very smallness of the stock in the case of seedling briars may cause the whole of it to be more thoroughly assimilated to the character and purpose of the Rose—that of producing a profusion of bloom chiefly. Certain it is, that Tea-roses worked on seedling briars grow better and bloom more than those on any other stock.

Other Rose Stocks.—Among these, almost the only one that threatens to rival those already named is the De la Grifferaie, a variety of the Multiflora Rose, sent out many years ago. It is a good climbing Rose, blooming in large clusters, with a robust habit and fine foliage. Its chief merit, however, is its free-rooting, growing, and taking qualities, which render it valuable as a stock. It roots as freely as the Manetti, and Tea and other Roses worked on this stock grow as rapidly or more so than on any other. The old Celina, Coupe d'Hébé, Charles Lawson, Crimson Boursault, Pink and other Chinese or monthly Roses, the Banksian, and such robust-growing Teas as Gloire de Dijon, and Gloire de Bordeaux, have likewise been used successfully as stocks. One of the newest stocks is that of *Rosa polyantha*, a single white, sweet-scented Rose from Japan. This is a vigorous-growing, free-rooting Rose, the stems running up so rapidly that it may even be useful for forming standards, and so become a rival to the natural briar of our woods and hedge-rows.

The rapid production by artificial means of stems sufficiently tall and strong for forming standards, is still a desideratum in Rose stocks, and probably such species as *Rosa polyantha*, *R. Brunonii* (see illustration), *R. Caucasia*, and the Crimson Boursault might help to supply this want. There are almost any number of dwarf stocks to supply all the rosarian's needs; but when he wants tall standards he must still betake him to the woods and hedge-rows in search of them. It seems high time that this haphazard hunting for briars should cease, and that the trade should grow their thousands and tens of thousands of standard stocks, straight as arrows, and full of fibrous roots as the most exacting could demand. A good deal towards this much-to-be-desired result might be done by judicious selections of seeds from the best strains of the Dog-rose, *Rosa canina* (see illustration), not only throughout this country, but Europe. There are a good many varieties of this species, some more and others less suitable for stocks. Possibly a cross with some of our hardy climbing Roses, or such species as those just indicated, might result in stocks as long as fishing-rods, and almost as strong, within three years or so, just the strains for making standard Roses.

For dwarf Roses the rosarian has a profusion of stocks, and is perplexed with the difficulties of selection. For open-air culture, probably the seedling briar, briar cuttings, the Manetti, and the De la Grifferaie are on the whole the best and the most easily provided in quantity. Such semi-tender stocks as the Banksian, Teas, and Chinas, should be used chiefly for Roses to be grown under glass.

The Manetti Rose Stock. — This Rose is still grown by its thousands and tens of thousands. It is a free-growing Rose of Italian origin, introduced into this country about forty years ago, and first brought into prominent notice as a stock by the late Mr. Thomas Rivers, of Sawbridgeworth, Herts. Being a most luxuriant grower and a free rooter from cuttings, and buds and grafts alike taking upon it with exceptional freedom, and growing upon it with unexampled rapidity, it soon became a fashion, then a rage, almost a *furore*. It threatened to banish all other stocks for dwarfs out of the garden. For mere growth, and growing on light soils, perhaps, there is no stock to match the Manetti. It is still so good that no rosarian should be without it, as it has special merits of its own, already pointed out. Probably more dwarf Roses are on the Manetti at this moment than on any other stock, and hence a good batch of cuttings of it should be at once inserted.

They may be made, planted, and treated exactly as seedling briars, November being the best month to make and plant Manetti cuttings. Custom and the most successful practice have also agreed in budding the Manetti low. This gives the Rose at planting two strings to its bow; it may either use the roots of its foster-mother as permanent helps, or may starve them off so soon as it can form roots of its own. The Manetti stock is equally suitable for either method, or the modern one more generally adopted—that of running two sets of roots abreast, to the fuller feeding and more powerful stimulation of the Rose.

Special Stocks for Different Roses. — In the present state of our knowledge comparatively little can be said on this subject. Singularly enough, however, some curious facts have been established. Such, for example, as that the Banksian has proved one of the very best stocks for the Marshal Niel; that the seedling briar is, on the

whole, the best stock for Teas; that the Manetti is admirable for Hybrid Perpetuals. Roses on this last stock are also earlier than on any other, with the exception of the Gloire de Dijon, which is one of the earliest as well as very best stocks for early Roses. But a halt must be called, lest the region of fact be forsaken for that of fancy; as the question of special stocks for particular Roses is as yet in a nebulous state, and what is here stated is ahead rather than simply abreast of what is absolutely proved on the subject. The time may probably come when, instead of being dependent on wilding Dogs, the art of raising and selecting Rose stocks will have been so perfected, and their natural or acquired affinities so thoroughly understood and appreciated, that almost every leading type of Rose will have its own stock, and thus be mated to the foster-mother that suits it best.

"This is an Art
Which does mend Nature; change it rather; but
The Art itself is Nature."

GARDEN WALKS AND ROADS.

ROADS AND LARGER WALKS.

TO make a garden without providing sufficient means of ingress and egress, is like hanging pictures in a cellar with only one narrow staircase leading down into its dingy light. The pictures may be gems of art, but they cannot be seen to any advantage, nor visited with any ease or comfort. It is just so with not a few gardens. They are full of gems of art and fine examples of natural beauty, but they cannot be visited with any pleasure, unless during exceptionally fine weather. Even in summer, when the gardens are full of beauty, a passing shower or day's rain renders the walks that lead to them soft and miry, and at times veritable sloughs of despond, from which ladies have been only too glad to escape, leaving their shoes behind them.

Admitting that such very bad walks are rare, it is to be hoped that for all future time they will become impossible. A demesne without good roads, as a garden without good walks, is shorn of fully one-half its charms. Facile and cleanly access to and return from house and garden are vital factors to their full enjoyment. Much has been said and written about the line of beauty in both, and that we will endeavour to illustrate alike by precept and example; but the direction is of far less moment than the quality. It is very much a matter of taste whether walks or roads should be straight or curved, stiff or meandering, offensively formal or softly melting into flowing lines of beauty; but it is an affair of absolute necessity that they should be hard and dry, and *inadhesive* in all weathers. Even the Garden of Eden would have failed to give pleasure had our first parents had to walk through its blissful bowers handicapped with half a stone of sludge on either foot.

The radical fault in road and walk making consists in trusting to the material employed rather than to the proper preparation of the ground as the basis of perfection in either: because stones, brickbats, builder's refuse, burnt earth, gravel, are hard and porous, and a foot or more of these is used to form good roads or walks, therefore these must continue good and dry. This popular error has caused more failures in this useful branch of civil engineering than all other fallacies put together. To give another extreme example to illustrate our point: try these hard materials on a swamp; they would simply disappear, like the mountain of earth that George Stephenson tipped into Chat Moss before it would carry his rails or carriages across. In a lesser degree, but by virtue of the operation of similar laws, millions of tons of road and walk materials are being lost or utterly ruined every year through resting on wet bottoms. The process of deterioration is slower, but equally sure as if the stones were cast into a morass; they simply sink into the mire; or, by virtue of the constant filtration of earthy particles from the upper strata of the road or walk, or the passage of rain-water, the mass of the road materials become assimilated to the character and consistency of mud.

The Foundation.—Another almost equally common and mischievous fallacy is that the materials are, in fact, the road, and bear the weight of the traffic; on the contrary, these are so much dead weight added to the foundation of the road; that is, the earth. It is the latter, not the former, that carries the entire burden of the traffic, whether carriage or pedestrian, plus the weight of the rubbish, stone, gravel, employed in making and maintaining the roads. Hence the vital importance of strengthening the foundation of our roads and walks before proceeding to make them. Just as the stability of our noblest buildings depends on the solidity and massiveness of their foundations, so also does the excellency and durability of our roads and walks. As to mass of base, we have a sufficiency, for the wide area of garden or demesne is at our disposal. But we may add to the durability and buttress the solidity of our base in two ways: by intercepting the surface water from above, and cutting off the rising water from below. The first is done by as nearly as possible rendering our road materials waterproof, and so placing surface drains as to remove quickly any excess of surface water that may lodge on the surface. Both of these, how-

ever, may be more properly discussed under the heads of Road-making and Maintenance.

But the interception and removal of all earth springs, and thus laying and keeping the foundation of the road or walk dry, should precede any attempt at making either. Hence the thorough drainage of the roadway is the first vital step in road-making; so important is this, that if not taken the others should not be attempted.

The deeper almost, in reason, the drainage can be carried the better, as the thicker the strata of dry soil beneath the roadway the better it will be, the longer it will last, and the less road material need be used to make and keep it good. The latter is a point of the utmost moment, as dry earth on the spot costs virtually nothing, while stone or gravel may range in price from three to ten shillings per square yard; and yet, bulk for bulk, dry earth forms as strong a foundation as either.

In practice, it is found that a layer of dry earth under a road, from two to four feet deep, generally suffices for a solid foundation for the road material. Hence, a drain four feet deep will generally be found sufficient. This may be formed either of tiles or stones, and should be made with more than ordinary care, alike in regard to material and fall, as it is obvious that it cannot be got at afterwards without destroying the road or walk. (See chapter on Draining.)

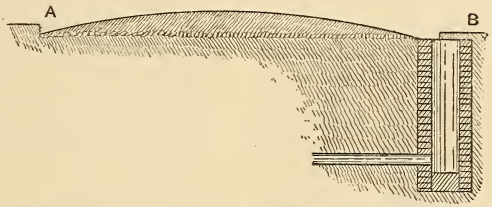


Fig. 1.—Section of Roadway, showing Level Base, with Convex Surface and Drain at Side.

The best place for the drain is the centre of the road, and, unless in the case of very wide carriage-roads, terraces, or walks, one drain will prove sufficient; where these, however, exceed twelve feet in width, and the soil is very wet or adhesive, one drain on each side may be necessary.

The form of the earthy base of the road is the next point claiming notice. As a general rule, there is no sounder one in theory, nor safer one in practice, than that it should be an exact counterpart of the form of the surface, that is, slightly convex in the middle, the degree of convexity being determined by the width, a ratio of an inch to six feet being a good proportion. The earth should then be made as hard and smooth as possible, ramming in the soil over the drain with the utmost care, so that its subsidence should not destroy the form of the road afterwards; and so likely is this to happen, consolidate as we may by artificial means, that, where practicable, it is safe practice to excavate and drain the roadway on walks some time before they are made. Neither must it be supposed that all roads and walks need deep drainage. On light, sandy soils, chalky gravel lands, the soil and subsoils are mostly sufficiently dry to carry roadways or walks, without this extra trouble and expense. But in nearly all heavy loams and clays, the first cost of thorough drainage will be found by far the least in the end.

The Surface.—As to the depth of road material necessary, that varies somewhat according to its quality and the nature of the base on which it rests; as already remarked, the drier the latter the less road material will be needed. Its function is simple, not compound. It neither carries nor is the road; its chief function, like that of iron rails on the line, is to reduce friction to a minimum by its hardness, and prevent the wear and tear of the foundation of the road. Hence, the ratio of its thickness may be measured by the degree of its impenetrability: the harder it is the thinner it may be. Thus, six inches of granite on a dry base would form a better road than sixteen inches of mixed road material of indifferent quality.

Uniformity of hardness, as well as of size and thickness of road material, are of the highest importance to the stability and uniform quality of roads and walks. The importance of the first and the last will be at once apparent to all. The importance of uniformity of size is but little understood in theory, and still more rarely attended to in practice. But a moment's consideration will show that every time a carriage-wheel mounts on to the summit of a stone larger than the average, it gains a coign of vantage with which to come down with such additional force as to scoop out a hole more or less deep upon the general surface of the road. Hence the tendency of all such roads is to become worse and worse. The ruts become deeper by every undue momentum of the revolving wheels, and the big stones help to cut the smaller ones through, to the utter destruction of the road. Uniformity of size in the road material would remove the most potent and ever-present destructive force from our roadways. Uniformity of hardness is almost of equal moment. Supposing granite here, and hard flints or brickbats further on, the granite would become a powerful means of smashing the latter into sheer uselessness, all the sooner by the operation of the same causes and laws as those already described. Similar evils, though in lesser degree, would follow inequalities

of thickness: one part of the road would be worn through before the others; the drawing strain on the horses increased, and unequally distributed; and the amount of friction, that is, the power of the road to resist the passage of the load over it, greatly augmented.

Smoothness and hardness of surface are the next points of most moment. The more perfectly these qualities are developed the more nearly will the road itself be rendered waterproof, and consequently the greater its force of resistance, and the longer it will resist the wear and tear of traffic. Fortified by resting on a solid dry base, and the materials of the roads compacted into a solid mass of uniform quality, they become well-nigh indestructible under ordinary traffic, while the smoothness and hardness of surface reduce the friction to a minimum. Such roads, with but slight repairs, last a lifetime; whereas, those indifferently made are ever on the anvil of constant repair, and seldom or never in good condition.

All these general principles of construction apply equally to much-frequented walks as to roads, and as the former have often to bear pony and hand carriage traffic for invalids and children, and in larger places not seldom regular carriage traffic, it is equally important that they should be well made. Besides, the qualities here indicated are almost as important for pedestrian as for carriage traffic, and the strain of crowds of people on the walks of public and private gardens upon fête and open-day occasions, now fortunately so common, is as great if not greater than that arising from moderate carriage traffic.

Construction.—The following practical instructions regarding construction will be equally applicable to first-class walks, and roads. The drainage and preparation of the ground have already been described. Instead of following the line of surface, some, however, prefer to make the base or earth line level or slightly concave instead of convex in the centre (A B, Fig. 1). This is supposed to insure more thorough drainage, the water falling from each side of the road into the middle and so into the drains. Perhaps, indeed, this form is more generally adopted than any other. In the illustration only one drain is shown, and that at the side. But, where needful, another could be carried along the other side. From the position of the overflow drain under the grating, it will be seen that this may be carried along under the centre of the roadway, and thus help to drain the road, as well as be placed in the best position for running drains into it from either side, as may be needful. The drains immediately under the gratings are carried deeper than the overflow drains for the collection of sediment, which can readily be removed, so as to prevent the main drain from being silted up. The prompt removal of surface water by some such means as this, is of immense importance in insuring the stability and durability of roads. The convex surface also enables rather more material to be used on the crown of the road, where it is said there is the most friction. This, however, is doubtful, and runs contrary to one of the vital principles already advanced—uniformity of thickness of road material over the entire surface.

Then as to the depth of materials. As wide a range exists in practice as that included between nine and eighteen inches—a foot on a solid dry soil base is ample, nine inches being a good average. As to materials, anything from small fagots to the hardest granite, iron-slag, and the most binding concretes and gravel, is used.

In situations where fagot-wood is plentiful and road material scarce and dear, a layer at least four inches in thickness of fagots may be used with advantage. Covered over with road material, and thus excluded from air and water to a great extent, it is astonishing how long the sprigs of trees and shrubs will last under a roadway, and how noiseless and elastic such roads continue for a period of from twenty to thirty years. But the use of this—relatively to good stone such perishable material—is almost confined to carriage-drives and roads through woods, &c.

A more common base for roads is a layer of ballast or burnt marl or clay. This is hard and porous almost as brickbats, forming a capital secondary base on the dry earth. Builders' refuse, the waste slag, clinkers, &c., from iron furnaces and foundries, and stones of all sorts, the harder the better, should follow. Roads subjected to heavy traffic should have a surface stratum of from four to six inches deep of pure granite, or other hard stones, such as greenstone, porphyry, basalt, &c.; neither can these stones be broken too small for the surface—from one and a half to two inches in diameter, the pieces weighing from four to six ounces, being the largest that should be employed. Where a surfacing of gravel is used over the granite, as is mostly the case in carriage-roads, the pieces may approach to double these weights and sizes. But the smaller the stones on the surface, the sooner they will blend into an impervious and impenetrable mass, and the longer the road will last. A road nine inches or a foot deep, with a layer of burnt earth and of hard stones of unequal size, the lower being the largest, and each layer as nearly as may be of uniform-sized stones, either with or without a surfacing of gravel, would be virtually indestructible under ordinary traffic, and with the slightest attention to repairs.

As soon as finished, rake perfectly smooth; water heavily should the material and weather be dry,

and roll until hard and smooth. The above materials may be varied to almost infinity, still being guided by the same general principles. For example: in chalky districts, chalk and the flints with which it is generally sandwiched will form capital roads, with a surfacing of gravel. Those who use flints should see that they are well weathered first, as exposure to the air for a year or two hardens them. Chalk usually forms a capital base for roads. Stones also abound in many places; gas-retort clinkers, iron furnace and foundry refuse, in others: all these, or, indeed, any hard substances, may be used with or substituted for the granite and gravel already referred to. Common concrete, formed of six parts of coarse gravel or stone, and one of quicklime, forms a good road. The same may be said of tar and clinkers or slag broken fine, and mixed so as to set hard. The durability and smoothness of asphalte roads are well known. Most of these kinds of roads and walks have been condemned for gardens and demesnes on account of their appearance and smell. The latter may be entirely got rid of by using Roman or Portland cement instead of tar, or by a heavy surfacing of gravel. By choosing the colour of the gravel to taste, the colour difficulty also disappears.

The most perfect carriage-road ever seen by the writer was formed of concrete about six inches thick, made of the refuse of an iron foundry and gas-tar, and just before being firmly set a layer of finely-broken red sandstone was rolled into the road, the result being that the surface was virtually composed of minute pieces of the latter, the whole being as hard as iron, neither carriage nor heavily-laden waggon making the slightest impression on the road. A garden walk even more beautiful was formed of one part of coal-tar, and six of coal-ashes, heavily sprinkled with Derbyshire spar before setting hard. At first sight this walk looked like an inlaid marble table; it was as hard as granite, and glistened in the sunlight like flashing jewels on the brow of beauty.

Taking into account that such roads and walks made once, may be said to be made for a lifetime, that they cost nothing for repair, need no keeping, weeds and worms alike failing to get foothold or live on such, it is astonishing that such materials are so little used for the making of carriage-roads and fronts, and garden walks and terraces.

Width of Walks and Roads.—As to the width of roads, that should be determined to some extent by their length. None, however, should be narrower than nine feet, few need be more than eighteen or twenty-four feet. The first is not any too wide for two carriages to pass each other with safety; the second is sufficiently so for the longest road in a ducal demesne. From ten to twelve feet is a capital average width. Few things look more mean than a narrow carriage-drive to a large demesne; nothing more snobbish than an eighteen or twenty-four feet road through a very small one—a pretentious stump perhaps not two hundred yards in length. The law of true proportion and congruity, if allowed free course, would prevent such mistakes.

From twelve to eighteen feet are capital widths for carriage-roads, and none to private residences need exceed twenty-four; roads that width should be a mile or more—the more the better—in length. The road should also be of uniform width throughout. This is very often not the case: the road starts boldly from mansion or lodge, with a stately dignity and grandeur, and gradually narrows and narrows, as if threatening to end in a squirrel-track and run up a tree. Those who construct their roads thus are likely to bring down on their work more ridicule than those who begin to build and are not able to finish. Of course, there are at times local obstacles and circumstances, such as rocks, rivers, ravines, hills, which render the narrowing of roads a matter of necessity. There is, in such cases, no objection to be taken on the ground of taste, as the reason is at once apparent. But nothing can be in worse taste than boldness and breadth at one or both ends, and the utmost degree of narrowness and attenuation consistent with safety throughout the greater part of the road. All carriage-roads and roads in pleasure-grounds should also be made of easy gradients throughout; and, fortunately for their possessors, the line of safety is also, as a rule, the line of beauty.

Carriage-sweeps.—The area of gravel terraces or roadways in front of the main entrance should always be ample, but not excessive, and should bear a strict relation to the size of the house, breadth and length of carriage-road, requirements of the family, &c. As a rule, it should furnish standing-room for from six to a dozen or eighteen carriages. The space may therefore need to vary from three hundred to three thousand square yards. The first might suffice for the front of a good country residence, the latter not prove excessive for that of a duke or a prince. For villa, suburban, or other residences, sufficient space to reach the house, turn round, and depart in safety, is all that is needful. And for such, notwithstanding what has been said above, a road carried round a clump of dressy trees or shrubs in the centre is not seldom the most convenient, and almost the only practicable arrangement. The shrubs, when planted to form an ellipse or circle, at once define the course of the road, and effectually shut out the front door and windows of

the dwelling-house from the dust and publicity of the public street or highway.

The range between five hundred and a thousand square yards will generally be found sufficient. It is most important that there should be ample space, without conveying impressions of excess; besides, as carriage-sweeps should be particularly well made and kept, they are expensive luxuries if too large. To curtail this expense, and also improve their appearance in the opinion of some, circles, ellipses, or squares, in the middle of carriage-sweeps, have frequently been laid down in turf, or planted with trees and shrubs. Occasionally, too, handsome vases, fountains, or groups of statuary, are placed in the centre of the space; all these are out of place in such positions, and seem exposed to so much danger as to mar one's enjoyment. Statuary in such positions is altogether too suggestive of the Italian boys with their trays of images on their heads to be permissible. Better boldly reduce the space to the necessities of the family; or, if this is impossible, give it all up to the use of the horses and carriages, with instructions that the whole is to be run over and kept in use for exercising the horses rather than not at all. The pear-shaped sweep (Fig. 2) is one of the most common and convenient. It should always be made of sufficient area to allow of a carriage and pair being driven easily round it. In this form of sweep it matters comparatively little where the front door is placed, the latter being almost equally easy of access from any portion of the bend. Perhaps no form affords more facile access and egress in less space than some one of the many forms of the pear sweep.

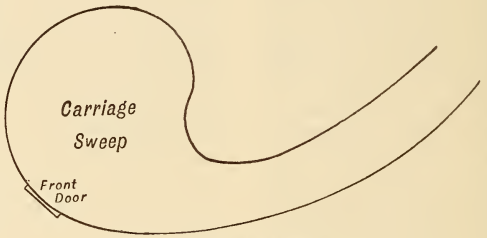


Fig. 2.—Pear-shaped Sweep.

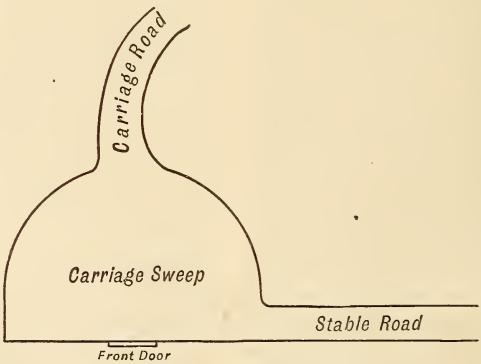


Fig. 3.—Semi-circular Sweep.

One most important point seems often overlooked in the formation of carriage-sweeps; that is, thorough drainage below, and the prompt removal of surface water. Nothing contributes so much to the latter as a slight fall from the house to the further side of the space. Sometimes they are made to fall towards the centre—this is a most unsightly arrangement. While the fall must be made efficient, it must on no account be excessive. As carriage fronts look best when apparently level, one inch or so to a yard, or even two yards, will suffice to remove the surface water if the surface is kept hard and smooth; and even when or where river or sea-shore shingle is employed for surfacing carriage fronts, the water will freely percolate through on such gentle inclinations. Gratings may also be placed on the outer edges, or wherever the surface is lowest, to receive the surface water, as in Fig. 1. This matter of inclination to insure the more thorough drainage and consequent dryness of carriage fronts is one of the most vital importance, as few things have a more depressing effect on the inmates, or convey a more painful impression of desertion and dilapidation, than stagnant water on a carriage front right up to the front door. This is not seldom the result of imperfect keeping, the allowing of ruts to be formed, and leaving them for days or weeks unraked and unrolled; but proper making would reduce such discomforts and disfigurements to a minimum. It is also well to delegate to some man or boy the duty of removing all manure or other litter from the carriage front once, or even twice a day. The time required is trifling; but the difference it makes in tidiness, comfort, and good keeping is marvellous. If during these processes the ruts, when needful, are also raked in, and a hand-roller run over them, the perfect keeping of the carriage-sweep will be insured.

Shape of Carriage-sweeps.—This is of less importance than size; squares or parallelograms are generally the most telling, close to the architectural lines of the house, or where the front is raised higher than the surrounding grounds, which is often the case, in order to bring it almost or altogether to the level of living-rooms, and the whole is supported by a retaining wall. Any other form, however, may be chosen that proves the most con-

venient. One of the most effective carriage-sweeps known to the writer is sixty yards long by thirty wide, and six feet above the surrounding ground. The proportion of the length, double the breadth, looks well, and is found most convenient. Fig. 4 is one of the largest carriage-sweeps that can be required for private residences. Were it found, however, too limited for the congestion that might occur in the traffic at the sharp bend leading into the stable-yard, the carriage-road could be led right through the quadrangle on the line of the garden gate, and swept back to the stable-yard under the retaining wall, thus affording sufficient space for the traffic of

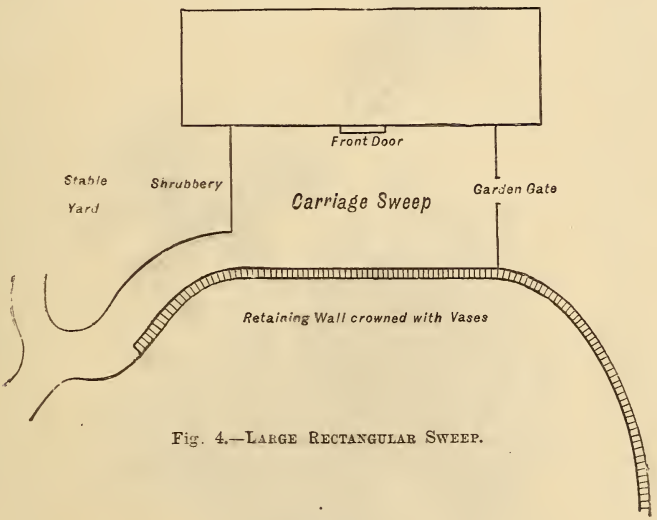


Fig. 4.—Large Rectangular Sweep.

a royal palace. As at present arranged, however, a block has never occurred, though at balls and public treats many hundreds of carriages have come and gone on a single day or night. On such occasions, however, not a few of these return, after depositing their fares, or are ranged on either side of the carriage-road at some considerable distance from the house. No doubt the sharp bend into the stable-yard is objectionable, and could easily be avoided by leading the road straight off the quadrangle of gravel into the yard. But the shrubbery is held in great veneration, as completely shutting out the stables from the house, and hence the sharpening of the bend into the yard.

Semi-circular, and circular, elliptical, and other forms look well, and one or two are given as samples, as well as to illustrate the best points of entering and leaving the carriage front. This should invariably be either in the centre, directly at right angles with the front door, or at either end. The piece of gravel constituting the carriage front, whatever its size or form, but more especially if square or oblong, forms a sort of secondary base to the house, and must therefore be treated with the mathematical precision of architectural, rather than the freer erratic irregularity of picturesque principles. It is well to bear this in mind, as during the period of sudden revulsion from overdone art to more natural methods of gardening, it was no uncommon thing to find magnificent mansions rising out of, rather than safely built upon, parks degraded into wild-looking commons, with furze, bramble, and wild bracken looking in at the drawing-room windows, and cattle, sheep, and deer browsing right up to the front door. This was nature dominating art with a vengeance. Proper carriage fronts and approach roads not only enable art to modify nature in the immediate vicinity of the house, but also impart that sense of safety and seclusion which is not one of the least charms of every home, whether in town or country. Both, however, are overdone when the carriage front is shut in with gates and bars within sight of the house, giving the latter more the appearance of a workhouse, asylum, or prison than a home. Not only are gates and bars in such positions objectionable on the ground of taste and sentiment, but likewise from the inconvenience and danger they involve. Starting with spirited horses, it is no easy matter to pull up almost directly to open or close gates. So far as possible, therefore, not only carriage-sweeps, but carriage-roads should be kept free from such constant sources of friction, hindrance, and danger as gates across them.

COMMON GARDEN FLOWERS.

ARABIS, ALYSSUM, AND AUBRIETIA.

Arabis. — The White Arabis, Wall or Rock Cress, is perhaps the most common, as it is assuredly one of the most beautiful and useful plants in cultivation. It seems to thrive almost equally well in town and country, and there are few gardens, large or small, new or old, that are not lighted up in April by one or more plants of the White Arabis. It grows freely in either sun or shade, on the level as well as on raised mounds, or sloping banks, though it flowers most freely either on a raised hillock or bank, on good soil of considerable depth. It is, however, by no means particular about soil or site, and will grow anywhere and everywhere the common daisies will thrive, and very often where these will hardly deign to live. The name of Wall Cress is supposed to be derived from the fact that the Arabis are often found in dry places, such as on the débris of rocks, mouldering ruins, or old walls. But in gardens the Arabis also thrives well on good soil of almost any sort. Some of the largest tufts of this fine old plant have been seen in kitchen gardens, a yard across, and as white as a sheet. Such large masses are most effective when slightly raised in the middle, or when facing the spectator upon sloping banks, either by themselves, or placed side by side with masses of Forget-me-nots or Aubrietias of almost equal size; the snowy whiteness of the Arabis comes out with great force and distinctness under such treatment.

ARABIS ALBIDA MAXIMA.

But the Wall Cress thrives almost equally well under a system of annual division. The plants readily lend themselves to this mode of increase or of culture; though not creepers, their wide-spreading dwarf branchlets root readily as they closely hug the ground; and should any of them fail to do so when attached to the parent plant, they root speedily and surely almost as soon as detached and placed firmly in the soil. The best time to divide Arabis is shortly after their flowers fade; and as the different species flower from January to July, it is wise to note that they should be divided by condition and not by calendar.

Cuttings will also root readily about the same stage of growth, if taken off with a small heel of the old wood, and placed in light, sandy soil, under a cloche or a hand-light. But as divided plants grow much sooner into flowering tufts of very effective size, it is scarcely worth while striking cuttings, unless where great quantities are wanted. The Wall Cresses may also be freely raised from seeds, though the finer strains, such as *Albida maxima*, do not seed nearly so freely as some of the more weedy species and varieties. The seeds may be sown in the open air, either in the early spring or autumn, say February or August, as most of the species and varieties are perfectly hardy—though sometimes the finer strains are rather injured by frost, partly through being over-excited by stimulating composts or rich soils. A rather fine, dry, poor soil should be chosen for sowing Arabis seed—especially if it should be sown in the autumn; as when forced up very rapidly into rank growth, even Arabis get much cut about in the winter or early spring.

The plants belong to the great family of Cross-worts or *Cruciferæ*, to which our Cabbages, Cauliflowers, Turnips, Radishes, Stocks, Candytuft, Drabas, Nasturtium, Aubrietia, Alyssum, and hosts of other families and species belong.

The finest species or variety of Arabis is *albida*, which was introduced from the Caucasus so early as 1798. This, with a larger-flowered strain of Wall Cress, *A. albida grandiflora*, is without doubt the finest Arabis grown, and leaves little or nothing to be desired in the shape of dwarf white flowers. There has long been a variegated variety of this species, which is almost four inches shorter, and is

altogether a weaker grower than the plain-leaved. This grows about eight inches high, and forms a pretty edging plant, either in or out of bloom. A still richer variegated Wall Cress is *A. lucida variegata*. There is a coarser variegated Arabis—*crispata*, the most effective of all on some soils. There are yet other variegated Wall Cresses, *Arabis procurrens variegata*, and *A. præcox variegata*, so that those in search of variegation have a rich find among the Wall Cresses. *Arabis alpina* is a good deal like, but is not quite so good as *albida*, and there is a superior strain of this species, called *alpina Clussiana*, introduced from Switzerland in 1596. *A. lucida* and the two Rock Cresses, *A. Alpestris* and *Petræa*, are also worth growing. There have long been purple and lilac-flowered Wall Cresses, such as *arenosa*, pink; *cebennensis*, pale red; *rosea*, rose; *retrofracta*, blush; but hardly any of these are worth growing. Quite recently, however, a charming species has been introduced from California, rejoicing in the name of *Arabis blepharophylla*, or Rosy Rock Cress. In general style and appearance this new species greatly resembles *A. albida*, but it produces its rosy-purple flowers in May. Should it prove as hardy as the other species, this will prove a welcome addition to a useful family of plants, though lovers of old and common favourites will probably think and say that a purple Arabis is a Wall Cress spoilt.

Aubrietias.—This highly ornamental family of old-fashioned plants belongs to the same great natural order of *Cruciferæ*. The leaves are much smaller, the plants more dense and dwarf, with flowers also smaller and more numerous than in the Arabis. There is another great and broad distinction: hitherto there has been no white Aubrietia, though now a white variety of *A. deltoidea* is reported; and they are all very much alike in colour —that is, of a lilac-purple or violet shade, differing somewhat in the depth of the shade only. The flowers also vary considerably in shape and size. The first-introduced Aubrietia was *deltoidea* —or Three-angled Flower—introduced from the Levant in 1710. The plant grows about four inches high; and the small purple flowers are so closely packed over the silvery-greyish leaves, as to hide them beneath a sheet of bloom during the flowering season, which lasts from March till June, the Aubrietias lasting far longer in flower than the Arabis. *A. purpurea* is a slightly deeper purple than *deltoidea*, and flowers later and rather longer. The flowers are also of a different form, and a little larger in size, the *deltoidea*, however, being generally preferred. *Aubrietia Hesperidiflora* is another purple variety, more like *purpurea* than *deltoidea*.

All these, however, will speedily be superseded by two new varieties, *A. grandiflora* and *Campbellii*—both wonderful improvements on all previous species and varieties. *A. grandiflora* is a larger and vastly improved edition of the original species. *A. Campbellii* is also of a deeper colour as well as of larger size, and is, without doubt, the finest Aubrietia in cultivation. Another variety, *Græca*, is a better strain of *deltoidea*. *A. Hendersonii* is of a deeper violet-purple than either of the others. Other and superior varieties are said to have been recently raised. The white sport or species will be most welcome, as there is no white common flower that quite matches the purple or violet Aubrietia. Even the smallest-flowered Arabis are too large, and also too tall in the stem, to run nicely with them. There are several partially variegated-leaved Aubrietias, but the variegation is neither so bold, striking, nor constant as in the case of the closely-related plants, the Arabis. The extreme smallness of the leaves, unless the variegation is very striking, as in the case of the Golden Lemon-thyme, is also against its effectiveness; and at present Aubrietias are more grown for their flowers than their foliage. Nevertheless, the variegated variety of *A. purpurea*—which is boldly margined with white — is frequently used as an edging plant.

The Aubrietias are perfectly hardy, and will grow in almost any soil, though, like most other common flowers, they pay well for a bit of good light loam, with a dash of leaf-mould in it, and fair culture. In good soil, with a dash of water in a dry season, Aubrietias are seldom out of flower throughout the year. On poor dry soil, the bloom is less dense, and the time they last in bloom is very greatly curtailed. From the dense trailing habit of these plants, they propagate themselves with amazing rapidity, rooting their stems as they run, so that the one speedily becomes any number at the will of the cultivator.

As to the best time for dividing Aubrietias, most authorities recommend spring and autumn. Neither of these is the best season, but rather about midsummer. Spring division injures the flower for that season; autumnal division does not afford sufficient time to permit of the plants being well established before winter, and the flower-buds developed and filled for spring blooming. Divide as soon after flowering as practicable, and the plants will get rapidly established, and will have sufficient time to recoup themselves from the check, and bloom the following season as if nothing had happened.

Propagation is also effected by cuttings. Small pieces of the half-ripened wood placed under a hand-light or in a close frame will root freely. As soon as rooted, harden off by partially removing the glass

every day when it is mild, and plant them in the open so soon as hardened off. Any light sandy soil will do in which to root the cuttings. It should be made firm, the cuttings needing the compression to force the emission of roots. Late cuttings should be inserted where they may have protection in winter.

Aubrietias do not ripen seeds very freely, excepting just here and there in warm and sheltered localities. Where they do so the seed should be sown very thinly and as soon as ripe. These plants do not come very true from seeds, but maintain general uniformity of height and colour, and within these narrow bounds the more variety and individuality the better. The genus was named after a French botanical draughtsman, M. Aubriet, and the first Aubrietias were introduced from the Levant in 1710. They now abound in all directions, and hundreds of gardens, large and small, would look poor and stale in the spring if the Aubrietias were withdrawn. They look well almost everywhere, anyhow, in large tufts or wide edgings, in juxtaposition with such plants as the Yellow or Rock Alyssum and the early Forget-me-not, *Myosotis dissitiflora*. With alternate patches of these, few plants can equal Aubrietias for the clothing of raised banks or rockeries, or intermixing with choice hardy ferns.

Aubrietia Campbellii.

The Alyssum.—For a brilliant display of light, almost fluffy, golden flowers throughout April and May, there is nothing to equal the grand old *Alyssum saxatile*, or Rock Alyssum, or Madwort, as this magnificent spring border flower is called. The name is derived, so it is said, from the supposed efficacy of the Alyssum to allay anger or rage. Were this true, this plant, popular as it is, would no doubt soon be more so. But this particular species at least is, we fear, too brilliant to exert any such soothing tendency. And yet yellow, although oftentimes associated with jealousy, is not the colour that is chosen to indicate rage or passion: scarlet, and the proverbial red rag, are too well established to be dethroned by any and every shade of yellow or orange. And the yellow of the Alyssum is a specially soft and soothing colour. Almost everybody admires it, and it contrasts and yet blends admirably with almost all other colours. The Rock Alyssum enjoys light and air thoroughly. To flower it in bright masses it should be grown quite in the open, and in no way overhung with shrubs, trees, or tall herbaceous plants. It enjoys a fine dry and open position, where every ray of the spring sunshine can be utilised and converted into waving plumes of golden beauty. Its flowering season is from April to June. In warm situations it flowers even later, but it is seldom seen in bloom till towards the middle or end of April. It refuses to thrive in a wet, sour soil, but if it only be dry it grows well and blooms in perfection, however poor the ground may be. The species reaches a foot to fifteen inches in height, its character being shrubby, not unlike that of Sage. There is a variegated variety which is equally beautiful. There is a smaller and more compact variety exactly like the species, only considerably smaller, *Alyssum saxatile compactum*. *A. montanum* is a native of Germany, and was introduced in 1713. It is of a dwarf semi-shrubby habit, and the flowers are much smaller than those of *A. saxatile*. It flowers in April, and hardly seems so hardy as the more robust and popular *saxatile*. *Alyssum argenteum* and *alpestris* are a good deal alike, but neither of them is at all equal to *A. saxatile*, or the mountain or rocky Alyssum. *Alyssum spinosum* deserves growing for its foliage rather than its flower. It forms a tiny silvery-looking plant of about six inches high, and is one of the neatest and most unique things in cultivation.

These shrubby and herbaceous Alyssums are propagated by cuttings, root-division, and seeds. They are not, however, by any means so easily increased as the two other families of plants here classed with them among common flowers. The wood of these

Alyssums is hard and semi-woody, and takes a long while to root. Flowering so profusely as *A. saxatile* and other kindred species, the plants grow slowly. Cuttings should be put in, in May, on a gentle hot-bed, and hardened off and planted out as soon as rooted. Thus treated they will bloom next year.

The best of the Alyssums do not readily lend themselves to root-division. But when this is possible, it affords a ready means of increase, which should never be over-looked or neglected. Some species seed rather freely, but as a general rule, and in most gardens, the better species of Alyssum seldom seed very freely. When seeds do ripen, save, and sow as soon as ripe, choosing a nice sheltered place for them, and sowing the seeds thinly to give the plants the full benefit of light and air from the first. It is bad practice to sow Alyssums under glass or in any confined place, as the plantlets are most impatient of confinement, especially in their infantile state. To have them in perfection, they should know no overcrowding from the time they break ground as seedlings until they die of old age.

Alyssum Saxatile.

What is popularly known as the Sweet Alyssum in gardens is a free-blooming, honey-scented white annual, the most popular of the family, extensively used for small beds and edgings. Its botanical name is *Alyssum maritimum*. It should be sown in the open air, where it is to bloom, at any time from February to May. When once introduced into a bed or border, it mostly reproduces itself, and holds its own, with little more trouble. There is a variegated variety of this, mostly propagated by cuttings, and kept over the winter under glass, the same as verbenas or other bedding plants, though this is also hardy in mild localities. This is known as the *Koniga maritimum variegatum*, grows to a height of from six to nine inches, has small white not very conspicuous flowers, but its narrow leaves are edged with silver, and it is altogether a very neat yet showy plant, well worthy of cultivation for small beds or edgings.

THE LIFE-HISTORY OF PLANTS.

By Dr. Maxwell T. Masters, F.R.S.

GERMINATION.

HAVING assisted at the launching of the new growth, whether of seed or of bud, and having indicated the nature of the mechanism, and of the processes concerned in that growth, we are now in a position to trace the subsequent career of the leaf-bearing shoots which originate in the manner already described.

Taking the seed first, the result of the processes before alluded to is made manifest in the germination, not of the seed, as we familiarly but very incorrectly say, but in that of the embryo plant within the seed. So long as it remains in that position it may be called the embryo; when it is set free and begins to take on an independent existence, it may be called a seedling; from that stage to that of the young plant, and ultimately to that of the adult plant, bearing fruit and seed, it passes in one continuous chain, without definite limits between the several stages.

The Radicle.—The first step in the germination of the embryo plant is invariably the protrusion through the ruptured seed-coats of the radicle or primary root. While still wrapped up within the seed, the point of the radicle is in most cases directed towards a small opening in the seed-coat, called technically the "micropyle." Through that aperture, which very speedily becomes enlarged and lacerated by the swelling of the tissues of the seed and of the embryo plant, emerges the radicle (Fig. 12).

It is usually of thread-like form, with a pointed end covered and shielded by a thin extinguisher-like cap, which preserves the young root from injury, as it is thrust from above downwards into the soil. Why the root descends more or less vertically into the soil—why it should not grow on sideways, or upwards, according to the position of the seed—is a

problem not yet completely solved; how it does so is more apparent, and the results are of course obvious.

The reasons for its descent are to be found in the circumstances by which it is surrounded, by its structure, and by its mode of growth. Gravitation has been shown by Thomas Andrew Knight and many subsequent observers to influence the downward course of roots, or rather, it has been proved that where the effects of gravitation are counteracted, the roots do not grow downwards. Knight sowed seeds on the outer side of a wheel kept rotating in a vertical direction. By these means the force of gravitation was overcome or replaced by centrifugal force, or the tendency to separate or fly off from a revolving body. Under these circumstances the roots always turn outwards, away from the centre of the wheel (Fig. 13). When the seeds are sown on a horizontally moving wheel, the roots assume an intermediate position between horizontal and vertical, as the result of a compromise between the tendency of gravitation to pull them down, and the tendency of centrifugal force to keep them horizontal (Fig. 14). The quicker the rotation of the wheel, the more horizontal the direction of the root.

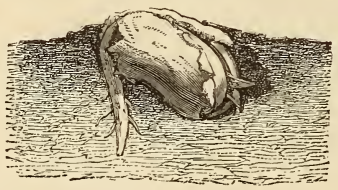


Fig. 12.—Germination of Bean. The seed-coats are torn, the radicle is protruded, and the arch of the caulicle is visible.

The presence of air is essential to the roots, and also the existence of moisture, provided that it be not stagnant or excessive. Then it is well ascertained that the growth in the length of roots occurs chiefly in one particular part of the root, and that the portion just above the root-cap or shield before mentioned.

How the Radicle Penetrates the Soil—Movement of the Roots.—The conical point of the root, thus protected, is thrust forward, or rather downward, into the soil by the lengthening that takes place just above it, the body of the seed and the superincumbent soil acting as the "fulcrum," or point of support.

And now comes into operation a very marvellous process, only lately brought to light, chiefly by the patient experiments of Darwin. It may be premised that all the growing parts of plants are endowed with a power of movement, now in this direction, now in that, and varying in direction and amount according to circumstances. These movements are not readily visible to the naked eye, except in some marked cases, but by various contrivances it is an easy matter to prove the fact. For the moment we confine ourselves to the movements observed in the radicles of seedling plants.

A short hair-like thread of glass, with a minute piece of black sealing-wax, was attached to the radicle by means of shellac in solution. By its side was placed a stick bearing a card with a black dot upon it. Then, by observing at stated intervals under a magnifying-glass the relative position of the fixed dot, and of the bead affixed to the radicle, the movements were rendered apparent, and, indeed, were "plotted" out as on a map. In some cases the radicles were allowed to grow over plates of smoked glass. As the tips of the roots moved they left a track in the soot by which the glass was covered, and their movements were thus rendered apparent.

It may then be taken as proved that one means by which the radicle penetrates the soil is by virtue of the power of rotary movement with which it, like all the other growing parts of plants, is endowed, and by means of which it penetrates the soil as the point of a cork-screw enters a cork. The pressure of the soil above and the weight of the seed give the requisite bearing, such as is afforded in the case of the screw by the pressure of the hand. Many radicles are invested with a fringe or sheath of fine "root-hairs," which grow out from the surface of the root and give that cobweb-like appearance which is so commonly seen when roots have access to moisture or to rich food. These hairs, of which we shall have to make mention later on, help to keep the root in position; and, moreover, they are endowed with the same gyratory motion as other growing parts. While increasing in length, the root increases in thickness also, especially above, so that its wedge-like or conical form is increased, and the force exerted by the growing root constantly increased; hence roots act, as Darwin says, "like a wedge of wood, which, whilst slowly driven into a crevice, continually expands at the same time by the absorption of water, and a wedge thus acting will split even a mass of rock."

This power of movement depends probably upon variations in the currents of liquid passing from cell to cell, causing turgidity now of this part of the root, now of that, and on the periodic passage from one cell to another of its contents; matters which will be spoken of later on.

Sensitiveness of Roots.—Before quitting the subject of the penetration of the soil by the root, it is necessary to allude to another marvellous property possessed by the growing tips of the roots, and exercised by them, in conjunction with the power of

movement. We allude to the property of sensitiveness.

When an organ is irritated by any cause and movement occurs as the consequence, the part is said to be sensitive. The tip of the root has been proved to possess this sensibility to impressions. A slight touch, the application of caustic, or the removal of a thin slice from one side, have all been proved to be productive of movement. But this sensibility is confined to the tip of the radicle for a very minute space, the consequent movement taking place at some little distance from the point of irritation. Thus, if the tip of the radicle be irritated, the portion bends away from the side which has been irritated. These curvatures are only manifested when the roots are growing under natural conditions. If the soil be too hot, or too cold, the movements are not observed. The curvatures resulting from contact are not always observable at once, but only after the expiration of some hours. As the tip, says Darwin, "is always endeavouring to bend to all sides, it will press on all sides, and will thus be able to discriminate between the harder and softer adjoining surfaces. . . . Consequently, it will tend to bend from the harder soil, and it will thus follow the lines of least resistance. So it will be if it meet with a stone, or the root of another plant in the soil. . . . If the tip were not sensitive, and if it did not excite the upper part of the root to bend away, whenever it encountered at right angles some obstacle in the ground, it would be liable to be doubled up in a contorted mass."

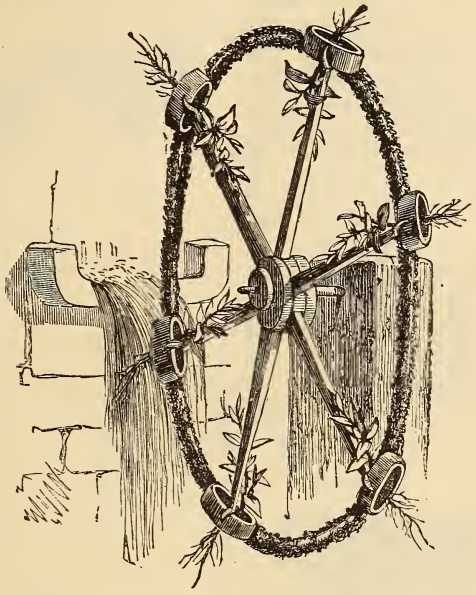


Fig. 13.—Knight's Wheel, showing the effect of growing Seeds on the surface of a vertically rotating Wheel.

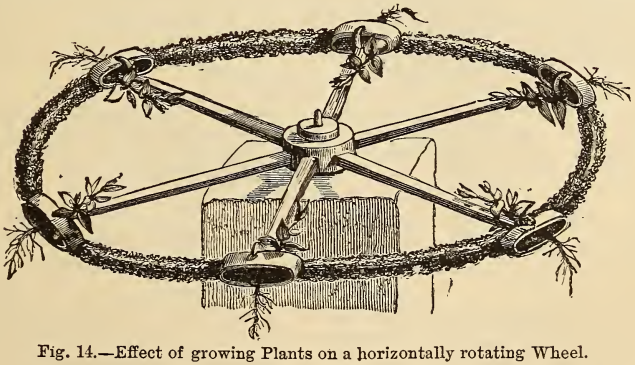


Fig. 14.—Effect of growing Plants on a horizontally rotating Wheel.

Above the apex, the radicle is also sensitive, but in this case the effect is to cause the radicle to bend, not away from, but towards the obstacle, so that it curls round it and gets on the other side of it.

In endeavouring to give an idea of what goes on in the tip of the root, and of the way in which it is thereby enabled to penetrate the ground, we may avail ourselves of the comparison made by Darwin between the snout of a mole or other burrowing animal and the tip of the root. By continual movement of the head, the animal feels any stone or other obstacle, as well as differences in the degree of compactness of the soil, and he will turn away from the harder side to that which is softer and moister.

The Caulicle.—While the radicle is pursuing its downward course provision is being made for the upraising of the seed-leaves, or "cotyledons," and of the bud or "plumule," which is destined to lengthen into the stem. Very frequently, but not universally, there is a little stalk intervening between the radicle and the seed-leaves; or it may more correctly be said that it always exists, but is sometimes so small as not readily to be visible. This stalk is the "tigellum," or "caulicle." It constitutes the white stalk which supports the seed-leaves of Mustard and Cress, and is particularly well seen in the French Bean or in the Melon (Figs. 15, 16, 17). It may be

known from the radicle in this early stage of growth by its cylindrical form destitute of branches (as a rule) and root-hairs. If, instead of being cylindrical, it tapers to one end so as to resemble a lengthened cone, the point of the cone is directed upwards in the reverse direction to that of the root. From its internal structure, absence of root-hairs, and other considerations, it is apparent that this caulicle, which most persons would confound with the root, is really not a root, and has not the office of a root. What the caulicle does is to upraise the seed-leaves, or at least the plumule (for the seed-leaves sometimes remain below the surface), to the

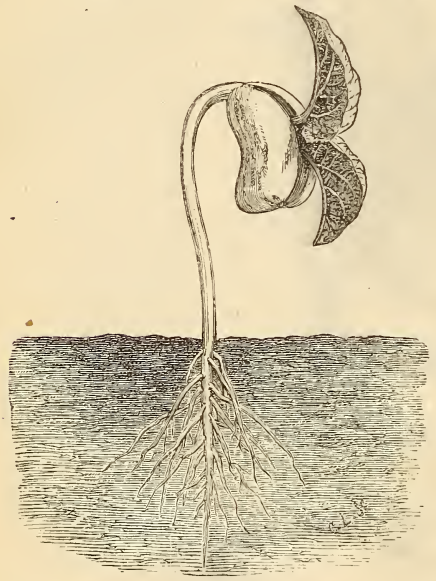


Fig. 15.—Germination of Bean, further advanced than at Fig. 12. The root has penetrated some distance and given off branches; the caulicle, still arched, has upraised the cotyledons and the plumule.

light and air. Later on it very frequently serves as a reservoir or store for water, or for nutritive substances; thus, the so-called roots of Turnips, Carrots, Radishes, Beet, &c., consist in part, at least, of developments of the caulicle filled with food substances destined for the use of the growing plant. So also it often happens that the root-stock, or "rhizome," is in part, at least, a development of the caulicle serving as a store-place for food, and indicating to the practical man that the plant possessing it undergoes a period of comparative rest, obtaining its supplies, till growth again begins, from its own resources. As it bursts through the seed-coats the caulicle has an arched form (Fig. 15), but as its tip becomes liberated from the seed-coat, it straightens itself, and by its upward growth thrusts the plumule into the light and air (Fig. 16).

Movements of the Caulicle.—While growing it worms its way upwards with the same gyrating movement that has been mentioned in the case of the radicle, though the movements in this case are

Fig. 16.—Seedling Plant of Melon. The primary root has decayed, but numerous branches have been formed, and the caulicle upraised to bear two leafy cotyledons, and the first bud or plumule.

less clearly visible and less distinct, owing to the counteracting influences of the soil, &c.

By means of the wriggling force exerted by the arching caulicle, the seed-leaves are at length dragged out of the ground, and the tigellum now straightens itself, by additional growth along the concave side, so that the convex side is, as it were, pushed into a straight position by the greater force of growth on the opposite side. Once straight and free, the caulicle moves more freely (Fig. 17).

The arching form of the caulicle (a form assumed also in many cases by other parts of the plants as they emerge from the soil) tends to protect the young growing point from abrasion, and not only so, but, as Darwin points out, the arching form, coupled

with growth at both ends of the arch, confers greater power in, as it were, upheaving the plumule. In the seed, the radicle, tigellum, and seed-leaves are often so placed as to be in one straight line; but when such seeds begin to germinate, the arched appearance of the caulicle is as marked as it is in those cases where the embryo plant is naturally coiled up in the seed.

The necessity for a fulcrum or bearing of some kind has been alluded to, and the way in which that necessity is met in ordinary cases. But it may be well to call attention here to a peculiar arrangement first observed by M. Flahault in the seedlings of *Cucurbitaceæ* (Melon, Cucumber, &c.).

In this case, the seed-coats are held down by the aid of a little hook or peg, which protrudes from the upper part of the radicle or lower portion of the caulicle, and becomes hitched over the lower part of the split seed-coat, fastening it down, as it were, and thus giving greater grip to the descending radicle and to the arching caulicle. In accidental cases where this peg is not developed, or is by some means prevented from effecting its purpose, then the cotyledons are uplifted with the seed-coats still attached to them.

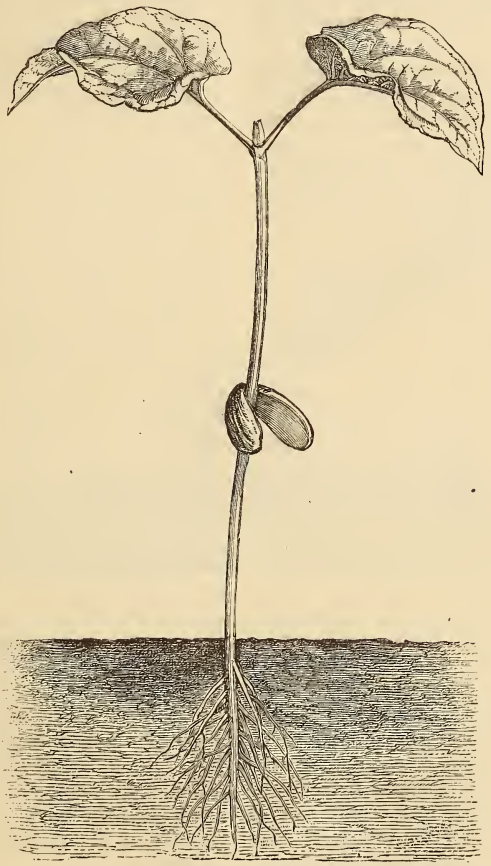


Fig. 17.—Seedling Bean further advanced, showing the radicle, the caulicle, the cotyledons, and above them the plumule, here lengthened and bearing a pair of leaves.

It is very probable that other arrangements of this nature exist in plants, but they have as yet hardly been looked for, though obviously the matter is one of some practical importance. We may conclude this portion of our subject by giving the substance of Darwin's illustration of the way in which the seedling plant breaks through the earth. Let us suppose a man to be thrown on his hands and knees, and at the same time to one side, by a load of hay falling on him. He would first endeavour to get his arched back upright, wriggling at the same time in all directions to free himself a little from the surrounding pressure . . . The man, still wriggling, would then raise his arched back as high as he could, and this may represent the growth and continued gyratory movement of the arching caulicle before it has reached the surface. As soon as the man felt himself at all free he would raise the upper part of his body, while still on his knees, and still wriggling; and this may represent the bowing backward of the basal leg of the arch, which in most cases aids in the withdrawal of the seed-leaves from the buried and ruptured seed-coats, and the subsequent straightening of the whole caulicle, the wriggling movement still continuing.

The Seed-leaves.—The lengthening of the caulicle, as just alluded to, liberates the seed-leaves or cotyledons, concerning which organs we must say a few words. In the seedlings of all flowering plants, disregarding a few exceptions insignificant in number, there are either two seed-leaves or one. Our great English naturalist, Ray, was the first to make this very important generalisation. Plants with two seed-leaves are technically called Dicotyledons or Dicotyledonous; plants with a single seed-leaf are called Monocotyledons or Monocotyledonous. This was a very important generalisation to make, because it is associated with other characteristics of leaf, stem, and flower, of external appearance and internal structure; so that a mere glance at a leaf or a flower is in most instances

quite sufficient to show whether the plant is a Dicotyledon or a Monocotyledon, without seeing the seedling at all. On the other hand, a botanist can safely predicate from the presence of two or only one seed-leaf, as the case may be, what the nature of the leaf and flower is likely to be. Of course, allowance must always be made for exceptions, but in this case the proportion of exceptions to the rule is very small indeed.

The cotyledons vary very considerably in appearance in different plants, so much so in fact that it is impossible to allude to all their variations of form. Those that are purely hereditary we may in this place pass over, but those which, by their special adaptation, facilitate the present life-work of the individual plant need some mention. From this point of view the most important thing to note is the leafy or the fleshy character of the seed-leaf. In some cases, as in Mustard, or in the Melon, and many others, the seed-leaves are little different save in form from ordinary leaves. (See Fig. 16.) In other cases, as in the Acorn or Almond, they are thick, white, and fleshy, so unlike ordinary leaves that by any casual observer they would probably not be considered to be leaves; nevertheless their position, mode of growth, and essential structure are those of leaves, so that no doubt whatever exists as to their real nature. This difference in character points to an important diversity in office.

The thick seed-leaves of the Acorn or Bean are filled with nutritive matter for the use of the young seedling. How that insoluble matter is rendered soluble and available as food has been indicated in a previous chapter (page 24). The thin green seed-leaves have no such store available, but they are so constructed as to be able to acquire food for themselves directly they are placed under conditions to obtain it. These differences are thus obviously connected with the circumstances, that as a rule the thick, fleshy, white cotyledons, as of Acorns, &c., remain below ground (hypogeal), while the thin leafy ones are invariably pushed up into the air and light, to put their green colouring matter into use at once in a manner we shall have to speak of in considering the office of the leaves (Fig. 16). The seed-leaves of the French Bean are thick, but they are often raised above the surface, and thus seem to be exceptional; but it will generally be found in such cases that the exception is more apparent than real, inasmuch as such seed-leaves, although thick, are green or become so.

Movements of the Seed-leaves.—The seed-leaves, like all other growing parts, are the subjects of movements such as have been described in the radicle and caulicle, but regulated by their position and attachments, as well as by external conditions—temperature, &c. In addition to these movements are certain others, called by Darwin "sleep movements," and which have been observed by him in a large number of plants of different orders. The effect of these movements is to place the two seed-leaves, which previously approximate to the horizontal position, in a more or less vertical direction, and nearly or quite in apposition. The object of these movements seems to be to protect the upper surface of the seed-leaf and the plumule from the effects of chilling by radiation. When leaves which usually close at night were prevented from so doing, the amount of dew upon the leaves forcibly kept apart was found to be great, while there was little or none on the closed leaves. "The position of the leaves at night affects their temperature through radiation to such a degree that when exposed to a clear sky during a frost it is a question of life and death." If this be so with ordinary leaves, it is likely to be so to a greater extent with the seed-leaves. Attention to little points of detail of this character, at present almost wholly unobserved, will doubtless serve to explain many peculiarities now vaguely set down to differences of constitution or habit, and will suggest to the thoughtful gardener the appropriate treatment in doubtful cases.

Practical Inferences from the foregoing Statements.—More obvious are the indications afforded by the different character of the seed, thick or thin-rinded, large or small, with thick or with thin seed-leaves, remaining below or thrust up above ground.

By an attentive consideration of the requirements for germination in general, of the physical and chemical changes that take place during the operation, and of the peculiarities of form and organisation of different seedling plants, the gardener may obviously gain many hints as to the best method of insuring the germination of the seeds entrusted to him.

The matter has also an important bearing on the question of adulteration or wilful seed-killing; thus, a perfectly sound sample placed under suitable conditions may be expected to produce 90—95 per cent. of seedlings, or, in fact, not one may fail. The same seeds put into the hands of an unskilful practitioner, or in less favourable conditions, may not grow more than 50 per cent., and this from no fault of the seedsman, and no defect in the seed.

The variation observable in the length of time required for germination depends also, doubtless, in a measure, upon the condition of ripeness of the seed. Thus, it has been shown that seeds of peas, beans, wheat, &c., ripen before the seed-vessel containing

them, and even before they have obtained their full size. In other cases the seeds do not ripen till after the fruit or seed-vessel has attained its maturity. Hence, whilst some seeds require to be sown at once, others germinate better if allowed to remain out of the ground some time, so as to allow of the slow changes in the seed previously alluded to. Where seeds quickly lose their vitality, as by drying, the process of stratification, or packing in earth kept just moist, is adopted, and this method is also one of the best to secure safe transit of seeds from the tropics.

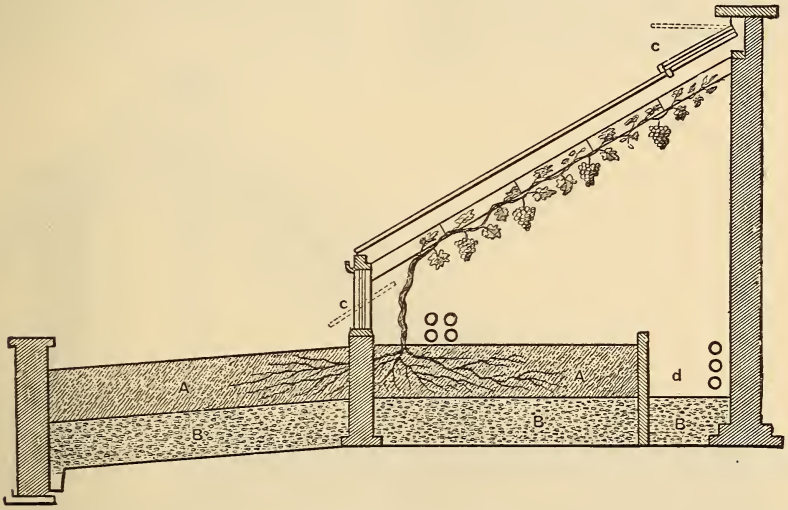


Fig. 1.—Lean-to Vinery.
A A, Border; B B, drainage; *c c*, ventilators; *d*, passage; ∞, pipes.

THE VINE AND ITS FRUIT.

By William Coleman.

INTRODUCTORY.

THE Vine, *Vitis vinifera*, is one of the oldest, as it is certainly one of the most graceful fruit-bearing trees we have in cultivation. Readers of the Old and New Testaments are well acquainted with the fact that its culture and uses were understood before the time of the Deluge, and that Noah, after leaving the Ark, planted for himself a vineyard and made wine—pure and unsophisticated, no doubt, which is more than consumers of the present day can say. In the Book of Exodus we learn that the spies sent by Moses into Canaan returned with an enormous bunch, borne between them on a staff. David often speaks of the vine, and finally, the Saviour Himself makes every Christian believer acquainted with it by His beautiful similes, and the way in which He has commanded us to make use of the wine in remembrance of Him. According to Sickler it grows wild on the shores of the Caspian, in Armenia and Caramania, and is indigenous to a large portion of Asia, whence it was introduced into Egypt, Greece, Spain, Italy, and France. Its introduction into Britain is shrouded in doubt. Some old writers think it was brought over by the Romans a few years after the Christian era, while others assert that it was not grown in this country before the year 280, when Probus, a great patron of agriculture in all the Roman provinces, was Emperor. Some have attempted to make the Phœnicians immortal by saying they brought the vine in the time of Solomon, when they visited the southern shores of this island for tin. Be this as it may, the Venerable Bede, a reliable authority, assures us that many vineyards existed in this country in his time (731), and when the Isle of Ely was known as the Isle of Vines, from which the bishop of that diocese received an annual supply of wine by way of tithe. William of Malmesbury, in the twelfth century, speaks highly of the county of Gloucester as a wine-growing district, where, as in the adjoining county of Hereford, traces of the flats or slopes on which the vines were grown not only exist, but still bear the name of "The Vineyard." We learn that excellent Burgundy was grown by the Duke of Norfolk at Arundel, in Sussex, while Pains Hill, in Surrey, was noted for the quality of its champagne. Walham Green, Rotherhithe, Bury St. Edmunds, and Belvoir Castle, on the borders of Lincolnshire, are also mentioned as having been famous for the excellence of their wine, which was little, if at all, inferior to that

grown in France. Such being the case, the Marquis of Bute's attempt and partial failure at Castle Coch, near Cardiff, in our own day, coupled with the fact that grapes now rarely ripen on south walls or sheltered gables north of London, can only point to the one fact, that our climate has greatly deteriorated since the time of the Romans, or, later still, since the advent of the Normans. It cannot be that the hand of the British cultivator has lost its cunning, as he is not in the habit of turning back when he has set his mind on the attainment of a certain object; neither can it be that the old varieties, still in existence, are less hardy than they were eighteen hundred years ago. A good deal, however, must be attributed to the fact that our forefathers' out-of-door grapes had not to contend against those of such superb quality as are now grown in vineries, and hence, no doubt, much more care was taken to select the sweetest and most luscious.

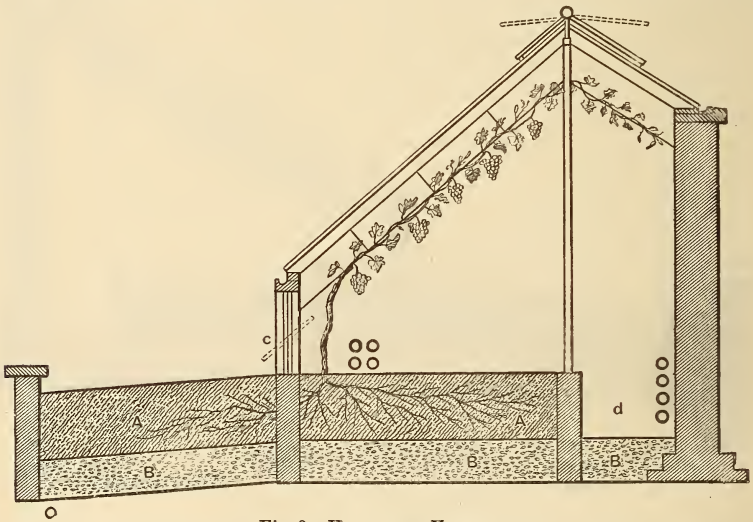


Fig. 2.—Hip-roofed Vinery.
A A, Border; B B, drainage; *c*, ventilator; *d*, passage; oo, pipes.

Large Vines.—In America it is no unusual occurrence to meet with vines, *Vitis labrusca*, three feet in circumference, with branches 200 feet in length. Evelyn, in his "Sylvia," speaks of vines of immense size, the timber from which was used for columns in the Temple of Juno. He also states that the great doors of the Cathedral at Ravenna were in his day discovered to have been made of vine planks, twelve feet in length and fifteen inches wide. Pliny mentions a vine that was 600 years old, and Strabo throws our own experience into the shade by giving the measurement of a vine as being twelve feet in circumference.

The largest vines in this country—including the fine old Hamburgh at Hampton Court, planted in 1769; the parent of the above, planted in 1758, at Valentines, in Essex, and said to be the oldest vine in England; the magnificent Hamburgh at Cumberland Lodge, Windsor, which fills a house 130 feet in length, produces more than 1,000 pounds of grapes annually, and supplies Her Majesty's table during her autumnal sojourn in Scotland; the Hamburghs at Eastnor Castle and Finchley, from which the finest exhibition grapes are cut by the hundredweight; and the Muscat at Harewood, near Leeds—are mere pigmies compared with the vines of the past. But when it is borne in mind that these veteran timber-trees were grown in the open air in countries to which they were indigenous, where the soil and climate were congenial to their requirements; and that the vines of which we are so justly proud are cribbed and confined under glass roofs—great credit is due to the British grape-grower, who aims at the quality of fruit rather than the quantity of timber, and sets as much value on the size of his berries as he does on the weight of the bunches.

Large Bunches.—It must not, however, be inferred that the Leviathans of the past did not yield large bunches and enormous berries, as we read that vines in the islands of the Archipelago produced bunches a yard in length, weighing 30 to 40 lbs.; and travellers in Asia Minor state that they saw grapes growing in the neighbourhood of Damascus,

the berries of which were as large as pigeons' eggs. Speechley, the gardener at Welbeck, towards the end of the last century, succeeded in growing a bunch of the Syrian grape which weighed 19½ lbs.; and several eminent grape-growers of the present day have repeatedly produced enormous bunches, which have never before been surpassed, if they have been equalled. About the middle of last century, the cultivation of grapes under glass in the gardens of the wealthy became pretty general; but it was not until timber and glass became cheaper that hot-house building became an important trade. This soon brought about a great alteration, not only in the mode of culture, but also in the varieties which were considered worth growing in heated houses.

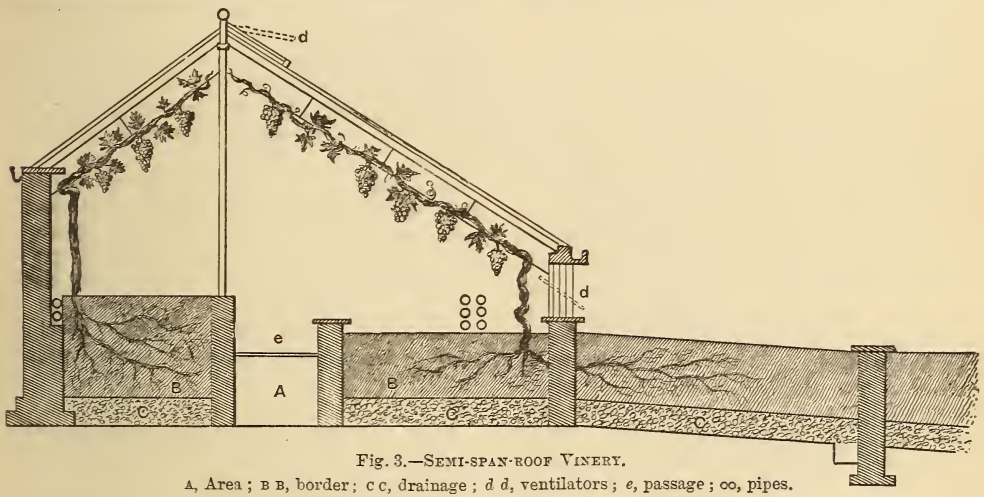


Fig. 3.—Semi-span-roof Vinery.
A, Area; B B, border; C C, drainage; *d d*, ventilators; *e*, passage; oo, pipes.

Down to that time all the varieties had been introduced from abroad, but now we have numerous English seedlings of the highest merit, which growers cultivate by the ton. It is estimated that English growers in 1886 sent 400 tons of grapes to market; Jersey growers supplied about 500 tons; and one tradesman in Kensington disposed of 40,000 lbs. to private customers direct. Houses of large size are springing up in every part of the United Kingdom, and the growth of the finest grapes in the world, with which our markets are supplied all the year round, now forms a very important item in our commercial enterprise.

HOUSES FOR GRAPE-GROWING.

To have first-class grapes all the year round, considerable skill and judgment are required on the part of the cultivator, not only in the selection of varieties suitable for the different seasons at which the grapes may be required in perfection, but also in the style of house, aspect, and mode of heating and ventilating. For very early forcing, as well as for the production of late crops of grapes, which are usually allowed to hang from the time they are ripe in September until they are cut and bottled in December, the lean-to vinery—that is to say, a house built against an existing wall—is in many ways the cheapest and best-adapted structure that can be used; as the substantial wall, which affords shelter from north winds, prevents sudden depressions of temperature in our fickle climate at a time when the tender growths are most easily injured or destroyed by cutting draughts, which cannot be so readily excluded from the now fashionable span-roof.

This house (Fig. 1) may be of any length and width, but a fair size for a private garden is 40 to 50 feet long, by 15 to 18 feet wide. The angle of the roof should not be less than 35°, neither should it be more than 40°, as sharp-pitched houses are always sensitive and difficult to manage in early spring. In modern gardens, where a lofty back wall would be objectionable, Fig. 2 will be found neat, compact, and well adapted for the growth of early or late grapes. It is a section of a house designed and built by the writer of these pages more than twenty years ago; and having given entire satisfaction, it is strongly recommended to the amateur or professional grower. The front faces due south, and forms what is termed a fixed roof, with sash-bars 18 inches apart. The glass is 21 oz., British sheet. The front lights work on a central bar of gas-tubing, and the top ventilator, which is hinged to the ridge-tree, is thrown upwards by rule-jointed elbows, firmly keyed to another bar of tubing running the whole

length of the house, with a short lever and handle, also keyed to the rod in the centre of the house. The front sill is placed on piers 4 feet apart, and the vines being planted inside, about 18 inches from the front, have the run of external and internal borders, as shown in the section. Many grape-growers object to internal borders, because, they assert, the roots of the vines are always found more plentiful in the outside than they are in the inside borders; but this is a delusion, or a condition brought about by mismanagement, as vines in all stages of growth require copious supplies of water, and when this important element is withheld from internal borders, they very naturally struggle to get a share of the refreshing moisture that is so plentifully poured upon the external roots by the hand of nature.

Fig. 3 is an illustration of a house also built upon the same principle for the growth of Muscats on the south, and that fine, but rarely well-managed grape, Black Morocco, on the north. The glazing and ventilating are in every respect similar to that in the preceding house; but the pipes, as will be seen on reference to the section, are differently arranged, and the border on the north side is cut off from the Muscat border by means of an area (marked A), which can be filled with fermenting material, running under an iron grating, which forms the path or gangway through the centre of the house. Although mid-season or late grapes can be grown in this house, it is not so well adapted to early forcing as the lean-to, owing to the large area of glass being exposed to the sudden changes of temperature we experience from the time early houses are started in December until the fruit has passed all the most critical stages in April. But for Muscats, which revel in an abundance of sun, heat, and light, and which usually have the best part of the summer for making their growth, the hip-roofed house, facing the south, has more advantages than the lean-to, while its appearance is certainly more graceful and pleasing to the eye.

Fig. 4 represents a true span-roofed vinery, which may be erected in any part of the garden, as the entire structure can be supported on either brick piers or cast-iron columns, rising to the surface of the borders. It is usual to set these houses to face east and west, that is to say, one end to stand north and the other due south, an arrangement which exposes the vines on each side to an equal share of sunlight, while the whole being glass, an abundance of air and light, so essential to the perfect growth and maturation of the wood and fruit, can at all times be obtained. This style of house is by no means new, as some of the finest and oldest vines in Great Britain are now growing under a span-roof. Neither is it expensive, unless the owner feels inclined to increase the cost by ornamentation to meet and blend with the surrounding buildings. One thing, however, be the house plain or ornamental, is very important—the quality of the materials of which it is composed. None but the best seasoned red deal should be used; all ornamentation should be secured by means of moulding or chamfering the solid wood in preference to putting on mouldings; all flat surfaces calculated to hold water or condensed moisture should be avoided, and none but the best British sheet-glass, white lead, and oil should be used for resisting the elements. If proof of these remarks should be wanted, the reader has only to go into the market-growers' establishments, where a shilling is never spent if a smaller sum will suffice, and where hundreds of houses of this kind are now producing tons of the best grapes in the world, to satisfy himself that the man who lives by his intelligence and industry, while building upon the plainest lines imaginable, uses the very best materials that money can buy.

From the foregoing pages it will be seen that direct sun-heat and light are of the greatest importance; but there is no rule without an exception, as good Hambro' grapes can and have been grown under glass where the aspect has been due north. Of course, the heating and ventilating must be in every way perfect, and the borders should be internal, not over-wide, well raised, and thoroughly drained.

Trellis for the Vines.—The trellis on which the vines are to be trained forms an important part of the structure. In old, heavily-timbered houses, it was usual to place three wires 9 inches apart and about 12 inches below the glass under each rafter; a system which answered fairly well when the squares were small, and every lap admitted a current of air: but under the modern mode of close glazing with large squares, a greater distance is now allowed, for the twofold purpose of admitting a free circulation of air above the fully-developed foliage, as well as to prevent scorching when the moisture is obliged to find its way to the apex ventilators before it can escape from the house. Many give preference to galvanised wires, running longitudinally the whole length of the house, 10 inches apart, and 18 to 24 inches from the glass. The mode of supporting the wires is entirely a matter of taste. Some use long iron pins, with a mesh at one end for screwing on to the rafters, and an eye at the other for carrying the wires, and when neatly fixed they look light and pleasing. But a plain substantial trellis can be secured by running flat iron bars, $1\frac{1}{2}$ inch by $\frac{1}{4}$ inch, from the front mullions to the back wall, 18 to 24 inches below the

apex, and supporting them in the middle with a light screwed pin, passed an inch or more into the rafters. These bars being of uniform length, with holes drilled through them 10 inches apart for carrying the wires, form a framework which cannot give way under the heaviest strain that is likely to be brought to bear upon it. As many plant and fruit growers do not approve of galvanised wire for training purposes, their objections can be easily overcome by giving the trellis two or three coats of paint after it is fixed. For conveniently carrying out the extension or long-rod system of training, the longitudinal-wired trellis is infinitely superior to the cross trellises, composed of three wires placed under each rafter.

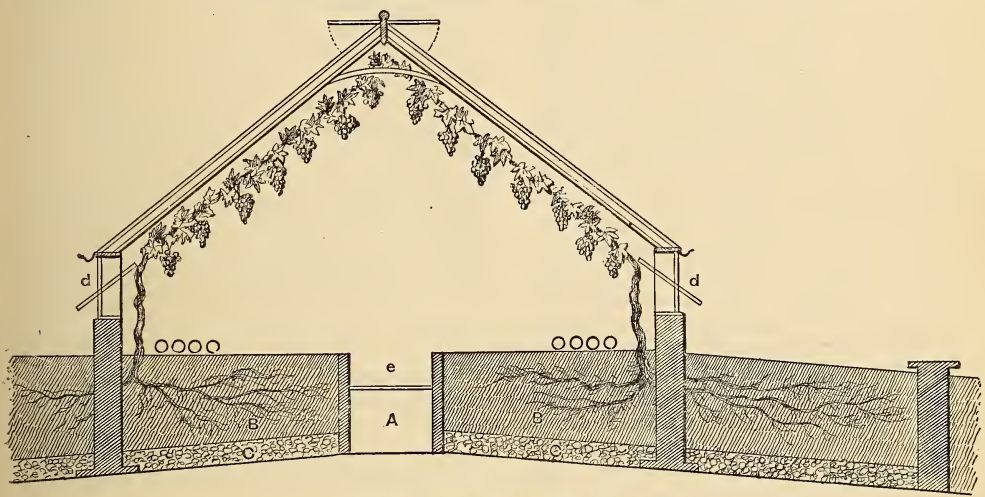


Fig. 4.—Span-roofed Vinery.
A, Area; B B, border; C C, drainage; *d d*, ventilators; *e*, passage; oo, pipes.

Artificial Heating.—Though there are several modes of applying artificial heat to vineries, it is not necessary to touch upon any of the old systems long since superseded by the introduction of hot water, which is at once the cleanest, neatest, and most efficient arrangement yet introduced to the horticulturist. Unfortunately for the amateur, the number of boilers before the public is so numerous that he will find it difficult to decide upon the best. During the last thirty years a great variety of cast-iron boilers have been introduced; but, owing to unequal contraction and expansion, the metal is liable to crack, and the apparatus is then rendered useless. Having before them the disastrous results produced by these mishaps, nearly all practical growers are now using wrought-iron boilers, of which the terminal-ended, welded saddle boiler, and the Trentham, or improved Cornish boiler, are by far the best. In large establishments where a great number of houses have to be heated from one stoke-hole, fitted with a pair of boilers working separately or together, the saddle and the Trentham are unsurpassed for power and economy. In the arrangement of the pipes, the fitter must, of course, be guided by local conditions and the purpose for which the house is required. As heated air naturally ascends, it has hitherto been thought advisable, while avoiding too close proximity to the stems of the vines, to place the stacks or tiers of pipes near the ground-line and in the coldest part of the house. For early and Muscat houses, more piping is required than in mid-season houses; but to insure an abundance of heat in severe weather, and to avoid over-heating at all times, the shrewd economist will always furnish his houses with ample piping. As a guide to those who have not had much practical experience in heating, "Hood's Tables," for finding the length of four-inch pipes required to heat 1,000 cubic feet of air per minute to from 45° to 90°, the temperature of the pipe being 200°, will be found useful and reliable.

Temperature of External Air.	Temperature at which the House is to be kept.									
	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°
	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.
10°	126	150	174	200	229	259	292	328	367	409
20°	91	112	135	160	187	216	247	281	318	358
32°	54	75	97	120	145	173	202	234	269	307
33°	47	67	89	112	137	164	198	225	259	296
40°	18	37	58	80	104	129	157	187	220	255
50°			19	40	62	86	112	140	171	204

To use this table, look for the lowest temperature in the left-hand column, and at the top for the highest temperature at which the house is required to be kept, and where the two columns intersect will be found the number of feet of 4-inch piping required to heat 1,000 cubic feet of air per minute. Example:—A house containing 10,000 cubic feet of air, which it is required to keep at 70°, taking the external air at 32°, will require 1,640 feet of 4-inch piping to heat it.

GROUND OPERATIONS.

TRENCHING.

THIS is one of the most important preliminary operations within the whole range of horticultural practice. If the maxim "Dig deep to find the gold" be true, and it is, how much more gold may be—is, in fact—found by trenching for it? No one can say how much, though without doubt it may be reckoned by millions and tens of millions sterling. For the statement that "mass is might" is as true of the earth as of mechanical force. The productive force of the earth may, in fact, be measured by its mass plus its quality. Now the very germ and substance of all good trenching is to add to the bulk of the cultivated earth, and improve its quality, by converting a certain amount of hard subsoil into porous surface soil.

Mere Inversion of the Soil not Good Trenching.—Mistakes about trenching have prevailed to such an extent as almost to upset its true theory, and arrest its practice. The simple turning of the earth upside down may be good or bad according to circumstances, although it has been mostly and almost everywhere bad. For it must be a very wretched surface soil, indeed, that would not prove something better than that found a yard lower down. Effeteness or sterility alone is not likely to contribute much productive force to surface tilths, and the lower-lying layers are mostly the worst soils or subsoils. Even the worms, the last discovered, though doubtless the first great creators, transposers, and transformers of surface mould, can make little or nothing of the harsh, sterile subsoil, but confine their operations chiefly to the surface, and the strata in semi-transition in direct proximity to it.

Nature, the great teacher of the cultivator, never attempts to improve her surface tilths by inversion. Under the economy of nature, surface soils are grown slowly but surely from the surface downwards, rather than from their base upwards. The gradual decomposition of the roots and tops of plants, the disintegrating and enriching forces of the atmosphere, the deposits left by water and the heat of the sun, all work from the surface downwards; even the worms always spread their rich excretions on the surface, thus being the first to teach the great modern art of top-dressing land. Subsoils are gradually transformed into soils in a similar order; the soluble substances held in suspense by the surface mould—and these are ever the most valuable—are carried down by the rains into the subsoil, and gradually though surely convert these into surface mould.

It is most important to bear all this in mind in order to gain all the solid advantages, and run as few risks as possible of injury to the surface by trenching. The first example of trenching ever observed by the author, proved such a failure that the soil had to be *untrenched*, to coin a word, before it could be of any use. It was simply inverted and turned over to a depth of four feet, the last two being sheer clay. During the winter and early spring the clay was as plastic as bird-lime. As the drought and heat of summer came it hardened into something akin to brickbats. Planted with broccoli, by means of a crow-bar, these simply refused to grow, or made such little progress as to be useless. The trenching, in a word, had ruined the soil. So the following winter it was returned, and carefully mixed during the process; and the whole mass, by the addition of enormous masses of stable manure, in a rough state, was converted into fairly productive growing soil. However, the vital mistake of mixing an excess of clay with the surface staple made the whole difficult to work, and unsuitable for garden purposes for years.

Tentative Deepening of Soils the only Safe and Profitable Trenching.—As we have already seen, trenching proceeds in an opposite course to nature in the deepening of soils. That suggests the necessity of the utmost caution, and hence the importance of proceeding a little at a time. The fundamental error in most trenchings may be said to lie in looking upon them as something done once for all, and not to be repeated for many years; and hence the temptation to trench too deeply. Of course it is often useful to practise trenching in this sense; in the planting of fruit-trees and bushes, for instance; as fortunately for such purposes it is not needful to trench so deeply as for the cultivation of less durable crops of vegetables and flowers. As little as eighteen inches or two feet is sufficiently deep for most of the former, and thus a fair soil or subsoil may usually be secured without serious danger of converting fruitful fields into barren gardens or orchards through heavy deposits of barren earths

on their surface. But vegetables should have a surface tilth of from three to four feet when possible, and this can be gradually and surely formed by successive trenchings without lowering the fertility of the surface during the process of adding to its mass, to the consequent augmentation of its power.

The best way of doing this is to practise trenching as a mixing and deepening, rather than an inversive process, and a thing to come into the regular course of cultivation at intervals of three or five years, rather than to be done once for all for a whole generation.

Tools.—Having, it is hoped, made the object and general principles of trenching sufficiently clear, an attempt will now be made to teach the general reader how to trench. The tools wanted for the operation are a garden-line, a measuring-rod, a set of stakes, a barrow, and a spade.

Garden-lines are made of varied lengths and stoutness, and are wound on a reel at one end, and furnished with an iron pin at the other. Handy lengths range from ten to fifty, or even a hundred yards, according to the size of the garden. In large gardens, however, several sizes are used, and long lines should never be employed when short ones will suffice, as masses of cord, especially when wound round a reel, are a long time drying. In all gardens, a proper garden-line should be used, as nothing looks more slovenly, or is in the end so wasteful, as the use of two sticks for a garden-line. The lines should be wound or unwound carefully, taking care not to twist the strands in the process. The less garden-lines are used in wet weather the better, and should they get wet by any chance, they should at once be promptly dried. When in use they should never on any account be left out at night, as the night dews or a passing shower will so contract the line as either to draw the pins or snap the line asunder, or so strain it as to ruin its quality.

Measuring-rods.—One or two should be found in every garden. They are most convenient in lengths of five or ten feet. The first is handy for short

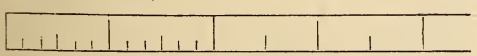


Fig. 7.—Measuring-rod.

measurements, and the second is as long as light splints can well be made without warping. The whole length should be marked in feet, half-feet, and inches (Fig. 7).

Stakes.—A set of about six or a dozen stakes are also most useful for setting out ground for digging, trenching, draining, and other purposes. Straight deal stakes pointed at one end, and ranging in length from three feet to four, nicely made and painted, will last a life-time, and are far more convenient and workmanlike than the common bits of hazel or other such light sticks so generally used, and often not to be found when wanted.

Barrows.—There are many different sorts, sizes, and materials. Garden barrows should be light, neat, and, relatively to others, small. Of course this does not apply to grass and leaf barrows, which cannot well be too large, but to those for earth and manure. The sides should also be so much sloped as to allow them to be emptied with ease. This is a point that it is difficult to get carpenters to attend to in the making of barrows, as the more the front and sides are bevelled, the more difficult to make. Hence, and also through fancy and habit, the majority of garden barrows have their sides and front too straight, which makes them difficult to empty; soil and manure having often to be removed with fork or spade, to the loss of time and labour. This becomes serious when repeated, as in moving soil for short distances, which may happen several hundreds of times in the day. There should also be three or more clear inches between the wheel and the front board of the garden barrow, to prevent its getting clogged on wet soil.

The Spade.—This is to horticulture what the plough is to agriculture, by far the most important implement in the garden. So much is this the case that, furnished with a good spade, the expert cultivator needs few other tools. It is most important that spades and their handles should be light and strong, and of such good quality that they not only last long, but improve by the wear and tear of frequent and constant use. Spades are made of different sizes, from sixteen inches deep and ten broad to nine inches by five. A capital size for amateurs is a foot deep by eight inches broad. The best spades mostly measure an inch or so less at the point or cutting surface than at the upper or treading part of the spade. All the best garden spades now are faced with steel, the back being iron; and this juxtaposition of two metals of such unequal hardness results in the iron wearing away first and leaving the thin steel plate almost as sharp as a knife for cutting its way through the soil. The top of good spades is furnished with a plate, called the treader, which increases the power of the foot in thrusting it into the ground, and also protects the shoes in doing so. Labouring men, however, often strap an iron treader under the sole of their boot to prevent the latter being injured or worn out in the act of trenching or digging.

In good spades the handle consists of two parts—the iron sheath and receiver, consisting of two sheaths with holes for three or more rivets through them, and

the handle, mostly made of the best seasoned ash, finishing with a hand-piece at the top, the whole being about two and a half feet in height. Blade and handle may either be made straight or with various curves or inclinations. A slight curve will add to the ease and force with which the spade may be used. The great secret of keeping a spade in good order is frequent use, and perfect cleanliness and dryness when not in use. A spade should be as carefully cleaned, and sharpened if need be, after use, before being hung up, as a carving-knife, if it is to prove efficient when wanted. Skilled workmen often keep their spades as bright as their master's plate, rubbing them with tallow to prevent rust when they are put aside for any length of time. It is impossible to exaggerate the importance of preventing the waste of physical force by such simple contrivances; and it is no exaggeration to add that a keen-edged bright spade will do double the work with one-half the exertion a dirty, blunt, rusty one requires. The merest tyro in gardening has only to try the difference for five minutes to determine him to take, for all future time, as much care of his spade as of his carvers. One more hint may be given here. Those about to begin gardening should look about among their labouring neighbours for a clean, well-worn, *second-hand* spade, presenting them with a first-rate new one for it. To dig or trench with a new spade is horses' work, and has cooled the enthusiasm of many at the very threshold of horticultural pursuits.

Methods of Trenching.—Assuming that a piece of ground twenty yards wide and thirty long is to be trenched, there are two distinct ways of setting about it. Mark a space off at one end a yard wide at the narrowest—four feet would be better—and commence to take out the trench, as it is called, a yard wide and deep, and wheel the whole of it to the far end, placing the opening soil, if possible, clear of the ground. This plan answers very well, but it involves the removal of twenty or more cubic yards or cart-loads of earth, that is, say one hundred and fifty good barrow-loads, for a distance of thirty yards. Until quite recently this seemed to be the most orthodox mode of commencing. With the idea of limiting the labour of transporting such a considerable mass of soil from one end to the other, not a few trenchers contract their opening as much as possible, leaving barely sufficient space to invert the soil. This, as we shall see, is so mischievous that such trenching is almost better dispensed with.

But now a much easier method is adopted thus: divide the twenty or any number of yards to be trenched into two equal parts as by the line A B (Fig. 8). Then the ground on one half—say from *a* to *c*—is trenched first, and the soil from *a*, instead of being wheeled to *c*, is thrown on the adjoining ground, *b*. When the last trench, *c*, of the first half-

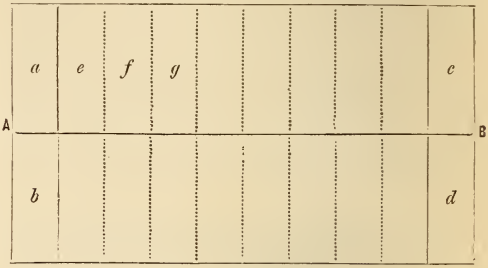


Fig. 8.—Trenching.

area is reached, the soil out of *d* is taken to fill it up and finish from *a* to *c*, and the process continues back to *b*, where the soil first thrown out is found ready to fill-in the last opening and finish the work. The saving of labour is not the only advantage of this method. Nothing injures soil more than the wheeling of heavy weights over it when at all wet; and as trenching is mostly winter work, it follows that the barrowing of the soil for the opening over the surface not seldom puddles the ground, and thus probably inflicts more harm than the trenching does good.

As to the trenching itself, the narrowest opening practicable is a yard; but if the trenching is to go deeper than a yard, a good rule is to make the width equal to the depth. Having determined the width of the trench to be first opened at *a* (Fig. 8), measure it off and drive a stake at each end, stretch a line from stake to stake, and cut a mark with the spade all along. Next proceed to dig out all the contents of the trench to the prescribed depth, removing the earth to either *b* or *c* as already described. The "opening," as it is called, will now be clear and empty from top to bottom; the operator will stand with the open trench in front of him a yard across, and the rest of the ground to be trenched in his rear; and the operation of "trenching" consists in placing all the soil from a second strip of ground, *e*, the same width as the trench, into *a*; of a third, *f*, into *e*; *g* into *f*, and so on; in doing which the whole of the soil and subsoil is more or less inverted, transposed, and re-mixed.

Before proceeding further, loosen up the base of the empty trench with a pick to a depth of six or more inches. It is good practice to apply a heavy coating of manure in the trenching of garden ground, and it will be assumed throughout that this wholesome practice is followed. The method, however, should be in all other respects the same, whether manure is used or not. Assuming that it is, place

a layer of rough rank dung two or three inches thick, if it can be afforded, on the top of the freshly-stirred subsoil. Then a yard of the ground (as at *e*) is marked off in the manner already described for the opening *a*; and this second strip is to be either simply inverted—which may be sufficient for shallow trenching in good ground—or skilfully manipulated and mixed in transferring it, into the opening. Of course, as the partly-moved soil will be lighter and looser than when it lay solid, it will occupy more space, and the ground will be raised even if no manure is used. In most cases the soil is simply dug out and thrown down in one mass, the top "spit" * being thrown into the bottom of the opening, the second following, and then the third; the soil being thus inverted as well as transposed. But this is the worst method, and the evil of bringing the lower layer to the surface may be reduced to a minimum by working each trench after the first opening in two halves, as shown by the dotted line, *a*,

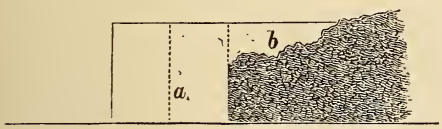


Fig. 9.—Half-trenching.

in Fig. 9. Here, instead of digging out the whole yard at once, half a yard is taken at a time. As this half-yard is used to fill up a trench of double the width, it will only fill it half full as at *b*. This half-stage is a good point at which to apply another dressing of manure; and then, when the second half-yard is taken and thrown on *b*, this top layer of new ground will also consist of half surface soil. The freshly-moved earth at *b* is always to be kept more or less on an incline as shown, which will also, for obvious reasons, favour the more thorough mixture of "tops" and "bottoms," the great end in all good trenching. When *e* (Fig. 8) is cleared, *f* is taken in the same way, and so on till the whole ground is gone over.

During the whole of the process of trenching, the crumbs—that is, the fragments that fall off the full spadefuls and from the edges of the cuts—should on no account be thrown out. The majority of workmen take out a full spadeful all over the trench, and then, either with spade or shovel, remove the crumbs, leaving the ground firm and clear for a second full spadeful, and so on until the bottom is reached. By acting thus, one most potential means of thoroughly mixing all qualities of the soil and subsoil into one homogeneous mass is thoughtlessly lost. Let the crumbs find their own level from top to bottom, and all the way through the work; and not a few of them will be found at the base of the trench, mixing freely with and forming powerful factors in the conversion of sterile subsoils into vegetable mould.

* A "spit" in gardening is the ground dug by one depth of the spade.

Keep the New Surface on an Inclined Plane.—This has already been mentioned, but is one of those matters of detail that is likely to be overlooked by all but those having much experience in trenching. The simplest way of laying the work on an incline is, to allow the last thrown-in three feet of earth to overlap the open trench by a foot or eighteen inches. The space will not thus be quite filled up to the level of the new ground. Hence, part of the next or third yard-space may be pitched over to form the surface of the first opening, while the major portion will go into the second trench in exactly the same way as the soil of the second filled the first. And, of course, by trenching each alike, the whole of the newly-trenched ground will be very much of the same quality.

Importance of Rough Surface.—It is quite a mistake to break ground fine in the process of trenching, unless in the case of very strong adhesive loams or clays, which may be improved by some slight subdivision, freely introducing old mortar, rough sand, or other disintegrators in the process. The majority of soils should be trenched in unbroken spadefuls, and especially should these be left as rough and whole as possible on the surface (Fig. 10).

Fig. 10.—Rough Surface.

As these masses or clods, as they are called, are mellowed down by time and other influences, the work of incorporation and thorough mixture of soil and subsoil will be complete, and the surface will gradually become fine.

What to Do with the Stones.—Unless very large, *i.e.*, exceeding two or three pounds in weight, leave all the stones alone in the lower strata. They are useful in keeping heavy soils more open, and in retaining moisture in light ones. Within a foot or so of the surface, all the larger stones may be removed. But unless the ground is very full of them indeed, it would be well to return most of those picked out to the lower strata. Not a few will condemn this advice as heterodox and injurious. It may be the former, because cultivators have been trained

to look upon stones in the soil, or subsoil, as their natural enemies; whereas, in moderation, experience has proved them to be among our best friends. Had the cost involved through incessant stone-picking been devoted to the deepening and enriching of surface tilths, it is probable that the produce of fields and gardens might have been doubled years ago. Of course, there are soils so much over-stoned as to be inconvenient for garden purposes; and in such, the operation of trenching will be made a means of reducing their numbers. But as a rule, in gardens, little or no stone-picking need follow or proceed abreast of trenching.

The Time to Trench, and After-treatment before Cropping.—October or November, or even earlier, should the crops have been previously cleared off, are the best months for trenching. The whole of the winter will at such seasons lie before the newly-trenched surface, and what that means must be seen to be appreciated. It is hardly too much to say that frostings and thawings, solvent showers and drying winds, convert sterile earths into fruitful surface moulds, and endow our semi-dead soils with life-sustaining energy and productive force. All these beneficial influences are enhanced if, some time in February or early in March, the newly-trenched soil is forked over in the opposite direction to what it was trenched, and once more the surface left rough, though on the whole even or level. The phrases seem contradictory, but they are not. Even very large clods may be so distributed that as they break and mellow into smoothness, the ground will be found sufficiently level for cropping purposes.

The Time to Repeat Trenching.—This will vary very greatly in different soils. Some soils that stand in great need of dressing may be trenched with advantage every third or fourth year; others may not need trenching again for eight or ten years. Hence a plan of all gardens should be kept, giving the date and a few other particulars, such as the time every portion of the ground has been trenched, drained, or specially treated. Such memoranda would prove invaluable indices and guides to future treatment, and explain many apparently inexplicably varied results to be noted in the same garden.

The ground should either be trenched backwards or across the next time, thereby insuring its being more thoroughly mixed. Generally, too, a gain in depth of from four to six inches may be safely made at each trenching, especially when a layer of manure has been spread over the subsoil. The greater perviousness of trenched lands allows of more air and water passing through; and these must carry some enriching elements with them, besides those gained from the chemical properties of the manure. All these begin so soon as liberated the apparently hopeless task of converting the barren, inert subsoil into fruitful mould. The earth-worms also work deeper, and grow fatter and stronger in trenched than in untrenched land, and hence exert a far more potent influence than they did before in the further improvement and enrichment of the ground.

THE FLOWER GARDEN.

By William Wildsmith.

SUMMER BEDDING.

THIS term is applied to that mode of flower gardening which consists in putting out plants of a more or less tender nature during the month of May and beginning of June; a method that has done more to foster a love of flowers and of gardening in general amongst the great mass of the people, than the most elaborate scheme—devised with that intent—could have been expected to accomplish. The system has its detractors, but those who would wish it discontinued have not yet told us, or shown us, an alternative way to produce the same pleasing combinations as is done by summer bedding; and till that time we must continue to plant out as usual, making such improvements as we can and shall, from lengthened experience, as to material and arrangement.

We ought, however, to note one or two of the principal objections to summer bedding, and the first is, "The plants are too tender, too short-lived," put out in June to be destroyed at the end of September. This we are compelled to accept as a valid objection, but it is to a large extent capable of remedy; though, certainly, the application of the remedy must be at the expense of some loss of colour. A little colour, however, can be well spared, for gaudiness is not beauty: a fact, which, if thoroughly recognised, with special reference to this matter, would tend to the reduction of gaudiness, and to greater refinement of arrangement. Hardier plants might be used more freely, of which there are numbers most suitable for the purpose now available, but which was not the case when summer bedding first came into vogue.

Another objection is on the ground of sameness, monotony—"One garden is just like another," and so on. To this the answer must be, blame not the system itself for this, but those who have the working out of the scheme. Why should two gardens be alike? Even if the same kinds of plants be used, a very moderate amount of individual originality will

meet this objection, and if put into practice would prove a complete remedy.

The last objection is that of the labour and house-room required to propagate and house the plants. This is the most valid objection of all, and relief can only be found by freer adoption of the plan named to meet the first objection, viz., increasing our use of hardy plants. A great advance is being made in this direction, and if it is still pushed on, summer bedding will ultimately be just as economically done as any other description of flower gardening. Even if it were not, however, so long as it is appreciated as it is at present, that appreciation is justification sufficient for its continuance.

Appropriateness.—Summer bedding is adaptable to any position where flowers are wished to be grown, yet is always most pleasing in a garden of *formal* design, the reason of this doubtless being, that for the most part the plants used are dwarf growers, of uniform habit and evenness of outline. Developing the same characteristics, they thus harmonise with the regularity and uniformity of the formal parterre; and here it may be remarked that, much as lovers of "hardy" flowers insist that their pets are just as well suited for this kind of garden as are ordinary bedding plants, we cannot accept an opinion so at variance with experience. They lack that evenness of outline, or balance of vegetation and colouring, which should characterise a garden of formal design. Hardy herbaceous plants, much as they may be supplemented with evergreen varieties, and suitable kinds of shrubs, are so irregular in their season of flowering, height, and general character, that they cannot be relied on to produce these effects. So long, therefore, as geometrically designed gardens exist, just so long will it be in good taste to furnish the same with plants that are at least amenable to something approaching uniformity in general appearance, and more especially so in regard to continuity and season of flowering.

Other appropriate places than a geometrical parterre are, each side of straight walks; or on a rising piece of ground that can be seen from the walks; or the opposite of this, a low and concealed part of the grounds, where the garden cannot be seen till reached, and then to be viewed from an elevated point. This latter sort of arrangement may be called a *surprise* garden; at the first sight of which the most cynical critic of bedding-out would be lost in admiration.

Colour.—In this respect tastes vary greatly, but there can be no doubt that the "quieter" the beds are, the more lasting and pleasing is the effect. The everlasting repetition of scarlet, yellow, and blue, which one occasionally sees, is so gaudy—not to say vulgar—that there is no wonder if, when such a sample is quoted as an average one of summer bedding, everybody possessed of the least good taste should repudiate the system. But then it is *not* an average sample, and happily the little there is, grows less and less every year. The colours which produce satisfying effects for the longest period are greys, blues, pinks, violets, and whites. Not that we would disparage high colours, such as scarlet and yellow; but, if we may use the term, these colours so *overpower* all others, that they should be used in less proportion and as centres, by reason of their superior vividness or weight.

We shall best make plain our meaning as to what is meant by the latter term "weight," as applied to colour, and what by that of "quietness," by saying that the two primary rules which a good flower gardener follows are designated Contrast and Harmony. Supposing a bed to be arranged after the first-named rule, it might be as follows:—scarlet, white, blue, orange; or again, bronzy-black, yellow, violet, green; and so on throughout all intermediate colours. Thus it will be seen that the rule of "contrast" is simple in the extreme, so far as concerns the selection of colours. Proportion, however, is not quite so readily determined, and it is very difficult to give any precise direction how it should be arranged, excepting to say that to avoid *weightiness*—or excessively high colouring—the lighter colours should predominate in the proportion of about three to two.

Harmony of colouring is usually the most satisfying. The term means—if one may so express it—the insensible blending of one colour with another, or what may be expressed as the gentle *leading up* of one colour to another. To give an example: we begin with white, then salmon, or light pink, dark pink, rose, light red, scarlet; thus making a transition from white to deep scarlet; which to write it seems as violent, as it really is imperceptible and pleasing when practically tested.

Those blessed with a keenness of perception for colour will not need such aids; but any who mistrust their ability in this direction should get a box of variously-coloured wafers, and spread them out in a strong light, till they get the colours arranged in such a way as best suits their taste. The veriest novice may with confidence resort to this simple expedient, in full assurance that he will be rewarded for his pains.

This much as to colour in detail; now as to the colour of the *whole*, that is, of the whole garden. Every bed, border, and vase should be arranged from this standpoint; for no matter how beautiful one bed or series of beds may be, if an adjoining set does not harmonise with them, there will be (to the educated

colourist) vexation of spirit for the whole season. There is nothing like buying one's experience dearly to make us more cautious about future failures; and having had thus to buy more than once, the following rule is the result:—Give *no special prominence* to any one colour; or, in other words, the various colours must be so dispersed over the whole garden, that if asked to decide which was the prevalent one we could not easily do so. The endeavour to carry out such a rule will of itself prevent any abruptness of colouring, and eventually perseverance will be rewarded by the realisation of the ideal.

Plans and Arrangements. — The arrangements of individual beds, as being likely to be of most service to the general reader, will here be treated of; and if the rule of *no prominence* be kept uppermost, it will be unnecessary to say anything further in respect of the more general arrangement of the above, except that all geometrical patterns should have their counterparts planted in exactly the same way, and there should be no *cross-corner* arrangements, such as some people seem to have a special affection for, but which surely cannot be real, and must be only occasional freaks of eccentricity.

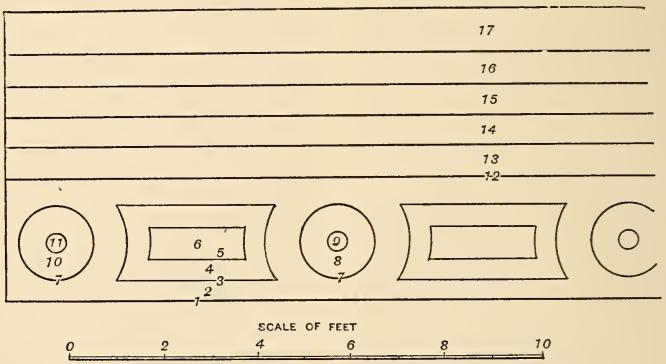


Fig. 1.—1, Box edging; 2, ground-work of Herniaria glabra; 3, Echeveria secunda glauca (slightly raised); 4, Alternanthera paronychioides; 5, Mesembryanthemum cordifolium variegatum; 6, large plant of Echeveria metallica, alternating in other beds with E. glauca metallica; 7, Sempervivum Californicum (slightly raised); 8, Sedum acre elegans; 9, Retinispora plumosa (about 18 inches high); 10, Sedum glaucum; 11, Cupressus Lawsonii erecta veridis (about 18 inches high); 12, band of Pyrethrum—Golden Feather; 13, Lobelia, dark blue, and light blue Viola (alternated); 14, Pelargonium Manglesii variegata and Sophia Dumaresque (alternated); 15, yellow Marguerites (Chrysanthemum Roi d'Or) and Blue Marguerites (Agathea cælestis); 16, single Dahlias in several colours, tied in spreading fashion to hedge; 17, hedge of Cupressus Lawsonii (5 feet high).

Till recently it was the general practice in all arrangements of summer bedding plants, to have no standard, or what we should now call *sentinel* plants, to break the surface-outline of pelargoniums and other similar dwarf plants. This notion of arrangement is totally at variance with good taste, or the charm which is always, and with truth, said to accompany variety; and yet the practice of so breaking the surface is, even now, anything but as general as it ought to be. The prominence given to such leading plants in the following arrangements will show that we, at any rate, do not consider the point a matter of little moment, but rather one which, whilst it insures variety, produces a tone of refinement throughout the whole, and effectively disposes of gaudiness and monotony of outline; whilst it is just as suitable for application to the most severe geometrical pattern as for the plainest symmetrical one.

It is also necessary to observe that the arrangements shown are made with a view of lasting for the *longest possible period*, independently of the weather; on this account many plants are set down here as summer bedders, which are not generally recognised as belonging to that order; but it may be as well to say that none are enumerated except such as have been practically tested as being in every particular good companions for bedding plants generally.

Design Fig. 1 is given as being a fair illustration both of the value of sentinel, standard, or "dot" plants, and a long season of effectiveness from a free use of hardy plants, more especially in the front parts of the design. These are so arranged that when the tender plants have succumbed to frost, the border still presents a furnished effect, only partially perhaps, but still sufficient to render it an object of beauty the whole winter through. The winter effect can easily be made still more beautiful, by planting "dot" plants (say small Heaths) in No. 6, and after clearing away the *Mesembryanthemum* and *Alternanthera* in Nos. 4 and 5, surfacing the ground with cocoa-fibre refuse, or better still, laying down flakes of *Sedum glaucum*, or in fact of any other variety. We have also used with excellent effect smooth turves of heather cut from a common—that which has been bitten down closely by rabbits is the best. The small shrubs in Nos. 9 and 11 root in such a thick fibrous manner that they can with safety be moved at any season, or twice or thrice in the season, if required;

their colours are so charming, and their habit of growth so dense and spiral, that they deserve to be noted as amongst the finest of shrubs for bedding-out purposes. It will be noted that No. 1 is a Box edging, and that there is a boundary hedge of *Cupressus Lawsonii*, No. 17. Both of these might be dispensed with; and if the bed is on turf, No. 1 must be so, while No. 17 is only suitable for positions where it is desirable to conceal a fence, road, or—as in this case—the vegetable garden, it being an actual arrangement on each side of the central walk in the kitchen garden, and repeated, almost *in toto*, of shorter length, as a boundary border at the end of a terrace garden, the fine spread of turf in front there being infinitely preferable to the gravel walk.

Though we have thought it best to set down all the plants actually used, were it intended to repeat the design we should exclude the Lobelia in No. 13, using only Viola, solely on account of the failure of the former before the end of the season.

The marking out of this plan preparatory to planting is almost self-explanatory, the most particular part being the central line running through Nos. 6 and 9, by which the panels, circles, and oblongs are formed. Measure off the correct distance from the centre of one circle to that of another, and the size of intervening ground-work; and with two strings reaching to these points and running round the pegs, the *circle* is formed by the shorter string, and the oblongs by the longer. It then only remains to rub out the straight lines enclosing the panels on the space for ground-work plant, No. 2, and the design is completed.

Design Fig. 2.—This is an excellent design for placing on each side of a long grassy glade, and equally so on but one side of a walk, if the opposite one be furnished with shrubs; or it may form one of the principal groups of beds on the parterre, the planting and size being varied according to taste and the position it is to occupy. It is designed with a view of showing how to *combine* two very opposite sections of plants—flat-growing foliage, and taller-growing flowering kinds. A further combination being, that whilst (like the preceding plan) it may be of any length, it may just as appropriately be either of one, two, or three panels (circles) in extent. "Sentinel" or dot plants, except in the very centres, have been purposely excluded from this design, for the reason that the heights of the plants themselves which are employed in it are sufficiently varied in that respect, and also because the narrow ovals, Nos. 5 and 6, are not good shapes for them, as they do not look well if they overhang or exceed the bounds of the panels in which they are placed.

In Fig. 2, the edging, No. 1, is raised four inches above the turf, the mode of doing which we shall deal with presently; meanwhile, it must suffice to say that our opinion is, that all edgings should be thus raised. The enclosing band, No. 2, of *Veronica repens* (green), whilst not objectionable near the turf, owing to the upright edging of grey and purple being between, renders the design adaptable to being surrounded by gravel. The ground-work, No. 4, enclosing the circles, being of a greenish-white in colour, and running through colours of blue, white, and dark purple, we get a combination of colouring, showing both *harmony* and *contrast* in the same bed, which must be seen for its beauty to be fully realised. Then the plants in Nos. 3, 5, and 6, being of higher growth than Nos. 2 and 4, if kept even in outline, and tapering to the centres of their respective plots, the undulations caused by Nos. 2 and 4 are of the most pleasing description. It will be observed that the plants in Nos. 1, 2, and 4 are *quite hardy;* and also the middle plants, Nos. 8 and 3, may be arranged with the hardy British plant, *Ajuga reptans purpurea*; then, when frost cuts off the flowers, a very moderate amount of ingenuity will be able to either wholly or partially fill out the beds for the winter.

The marking out of this design is just about as simple as the previous one. Run a line through the middle of the border; then draw circles to the enclosing horizontal lines; divide these circles into four parts at the outer edges; from each of these four points draw other circles, and thus is formed the half-circle on each side of the design.

Design Fig. 3.—This is of a less elaborate nature, but arranged on the same principle as the foregoing, and is a very suitable arrangement for placing in an isolated position where it is desired to have a bed of a formal description. We have seen and admired this pattern on the plateau of a villa, and have also made use of it in a large garden. In this latter connection, its most telling position is between beds of similar size which are filled with plants of one or two colours only, and which need some assistance in the way of refinement and "*dressiness*," other than the extreme of that which regular "carpet-bed" patterns produce. As regards size, that may be of any extent proportionate to the place it is to occupy; but if very large we should divide it into six or even eight parts, instead of four, and thus have six or eight beds; and the middle circle would also, of course, have to be enlarged. The eye would be the best judge of proportion for any particular spot it is to occupy.

Design Fig. 4 is a still simpler design, but none the worse for that; for, as a rule, the least complicated

patterns are the most effective, and as to their requiring less labour to plant and keep, that goes without saying. It is sometimes difficult to give a *reason why* certain designs and arrangements, which are nearly allied in every particular, have very different effects when placed in juxtaposition with other beds; but this and the preceding design shall illustrate our meaning. Both of them have been used in the positions mentioned as best for Fig. 3, and also as "breaks" between the most formal carpet patterns, and both answered their intended purpose very well. But every one was struck with the superiority of effect which Fig. 4 had over Fig. 3, when in *close* done by the late Mr. Beaton, which simply consisted of the old but still valuable *Verbena venosa* and variegated *Pelargonium Manglesii*. The light purple flower of the Verbena, the white and green foliage and light pink flower of the Pelargonium, mixed in about equal proportions, in a bed some twelve feet long and eight wide, produced a picture which, for softness and chasteness of colouring, may have been equalled but has never yet been excelled. Great advances have been made in other directions; but this piece of colouring was perfect at first, and could never be improved. Viola Blue Bell, and Pelargonium Flower of Spring; Purple King Verbena, and

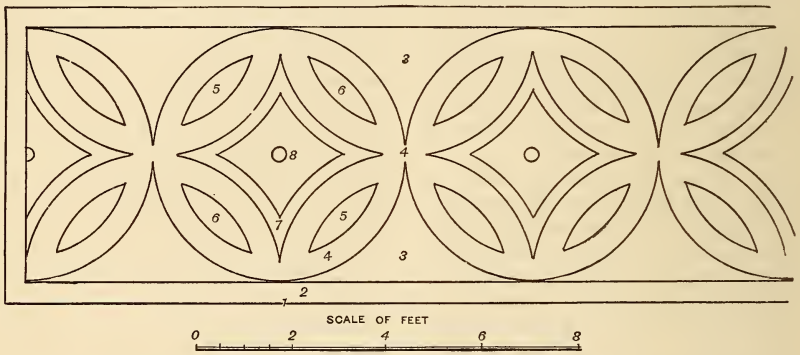


Fig. 2.—1, Raised edging of Sempervivum Californicum and Sedum glaucum; 2, band of Veronica repens (green); 3, Alternanthera magnifica, or, in cold district, Ajuga reptans purpurea; 4, ground-work of Sedum acre elegans variegata; 5, dwarf Ageratum; 6, dark blue Lobelia; 7, Gnaphalium lanatum (pegged); 8, a central plant of Yucca recurva, and the bed filled out with pink Pelargoniums and Agathea cælestis; and, in alternate beds, a central plant of Retinospera plumosa aurea, and the bed filled out with dark red tuberous Begonias and rose-coloured Pelargoniums.

proximity to the carpet-beds. One can only surmise that this was owing to the simpler lines of Fig. 4 being in greater contrast to the more intricate lines of the "carpet" patterns. Such an occurrence only shows how much has yet to be learnt before the perfection of flower gardening is attained.

Any other illustrative plans are unnecessary for this section of bedding-out. The four examples given, and the hints as to colour, particularly with respect to the *garden as a whole*, ought to be a sufficient guide for any one that knows anything at all about flower gardening.

Shot-silk Beds.—We will, however, note one or two *mixtures*, or what the late Mr. Donald Beaton christened "shot-silk beds;" not a bad name either, for if well done, the colours, when seen from a distance, present the characteristic of changeableness, as do those of a shot-silk dress. Fortune favoured the writer to see the very bed, and indeed to plant it once, in the same way as it used to be yellow Calceolaria; *Centaurea candidissima* (white), and pink Pelargonium, all make excellent "shot-silk" arrangements. For a very large bed or border, the following mixture is grand in the extreme:—pink Pelargonium, *Coleus Verschaffeltii* (dark brown), Crystal Palace Gem Pelargonium (golden variegated, with rose-coloured flowers), and Ageratum Imperial Dwarf (light lavender), with standard plants of light-flowered Fuchsias a yard apart.

The same plants are also very telling arranged after "the ribbon border style." These mixtures are every way to be preferred to large masses of one colour together, no matter whether they be high colours or the reverse.

In closing our remarks as to arrangements, that the injunctions as to variety and interest to be derived from a free use of standard plants throughout the garden may not be forgotten, we add a list of plants which may be used for that purpose:—Abutilons, *Acacia lophantha* (seedlings), Cannas, *Draeæna Australis*, Fuchsias (tall), *Grevillea robusta*,

Humea elegans, *Ricinus Gibsonii*, *Solanum robustum* and *Solanum marginatum*, *Wigandia Caracasana*, and several kinds of evergreen and variegated shrubs.

Planting the Beds.—This of course implies that they have been properly prepared, and that according to the requirements of the particular plants. Thus another matter turns up, viz., that the beds should be marked as to the plants they are to be planted with, before the preparation of the soil begins. All large foliage plants, most of the very tender kinds—Violas, Verbenas, and Calceolarias—ought to have abundance of manure and deep tilth.

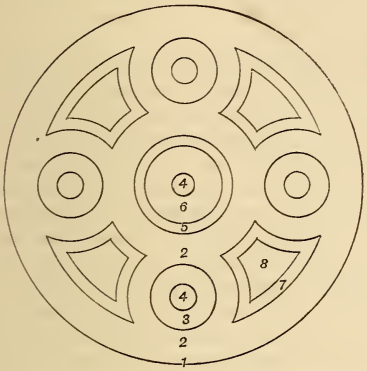


Fig. 3.—1, Raised edging of Herniaria glabra; 2, ground-work of Sedum glaucum; 3, edge of Mesembryanthemum cordifolium variegatum, and filled in with dwarf blue Ageratum; 4, Dracæna Australis lineata; 5, Euonymus aurea variegata; 6, scarlet and rose-coloured Pelargoniums intermixed; 7, Ajuga reptans purpurea; 8, pink Pelargoniums and white Viola (Mrs. Grey), intermixed.

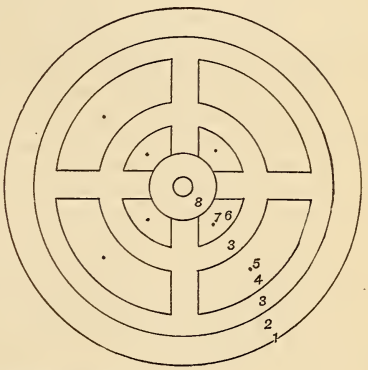


Fig. 4.—1, Edging of Sedum acre elegans variegata; 2, band of Alternanthera amabilis; 3, ground-work of Cerastium tomentosum; 4, edging of blue Lobelia, and filled in with tricolor Pelargonium; 5, Grevillea robusta—single plants; 6, edging of Coleus, and filled in with pink Pelargonium; 7, Abutilon (Boule de Neige)—single plants; 8, edging of Erica herbacea purpurea, filled in with Fuchsias of any colour in mixture.

Ageratums, Pelargoniums, Petunias, and the great bulk of the common bedders, flower most freely when the soil is *not* over-rich.

The edgings of all beds that are on turf should be raised at least three inches above it. All our own are thus raised, and are every one planted with *Herniaria glabra* (green). We have tried many kinds of plants for this purpose, but this excels all others. The edgings are made up as follows:—The soil for about eighteen inches round the bed is forked up, weeds and small stones are picked out, and the soil sprinkled; then, in the case of round beds, it is trodden an inch or two over the turf, and made firm to the height desired; then the circle is struck from the centre of the bed to the edge of turf; the soil being cut away with the edging-iron, or a sharp spade, and thrown into the bed, which is now ready for digging. For long and square beds, and all beds with straight edges, a plank is fixed edgeways, by driving pegs into the turf; then the soil being made fine and sprinkled, it is trodden against the plank till of the right height; the plank is then removed and the edge is complete, except a bit of levelling at the surface of the beds. It is necessary to plant such edgings as soon as made up; otherwise it is difficult to do, as the soil gets hard and crumbly. The Herniaria, besides being the best, is a most accommodating plant for this work, as it splits up so readily, and every particle will grow. Edgings four inches in height should have two rows of these particles put in; one row would do, but it is desirable to get the edgings covered as soon as possible to prevent cracking of the soil.

The planting out of bedding plants should never be hurried. Careful planting has its reward in forcing the plants to start away into growth at once. Thorough watering ought to be a first consideration before a plant is put into the ground; for should they go in dry, in that state they will remain, so far as the balls are concerned, the whole season. Again, the soil ought to be well compressed round the plants, and *with the hands* too, not with the trowel. After planting a good watering is desirable, which aids in settling the soil about the plants; and if a surface mulching can be at once given either of fine soil, vegetable mould, or cocoa-fibre, it will conduce to the advancement of growth.

THE KITCHEN GARDEN.

By William Earley.

SHAPE, DISPOSITION, AND FURNISHING.

The Shape or Form.—The shape or form of the kitchen garden often varies of necessity, in accordance with the extent of ground, &c.; but where a given space can be set apart for it, I consider an oblong square with the corners taken off is far the best for wall-fruit culture, for securing the largest number and extent of good aspects, both for tender border vegetables and for wall-fruits; to say nothing of the fact that the deeply-shaded, valueless, and extremely ugly corners connected with high square walls are entirely neutralised. It is full time, however, that old notions and practices in connection with the matter were exploded, once for all. If an oblong with its corners taken off is better than the old square, an ellipse would certainly exceed in utility the latter, and there can be little or no reason why such walls cannot be so built. By this means sunshine would be more general on the least sunny aspects, and a more general diffusion of indirect light be always insured. A merging of the advantages possessed by individual aspects will be secured, to the disadvantage of none. Indeed, such an arrangement will be to the especial advantage of winter, early, and tender vegetable crops. By the simple process of squaring the walk around the outsides, more extensive space at the better parts will be assured. East and west will be brighter, and the northern aspect less dark and dull, without interference with the centre, or main shape internally. The larger "quarters" should be square, walks being made centrally east to west and north to south, traversing each other centrally; other, or duplicate walks, as required; where large gardens exist, being so arranged as to maintain the divisions of quarters in square form also. Finally, whatever shape be employed for the chief wall, which should not be less than twelve feet high, I again advise, in preference to the accustomed practice, that the aspect selected be one south-east, as against that of south, commonly employed. The morning and full-day sun will act more beneficially throughout the day on the former than on the latter choice of aspect.

The Disposition and Furnishing.—The disposition and furnishing of the kitchen garden follow readily on the "mapping," or pegging out, of the pathways. A favourable addition to the surface soil is first made by wheeling the soil from out the walk-spaces thereon, removing a depth of at least one foot of such soil to make ready for the walk-constructive materials proper. As the entrance into this area will be, as previously intimated, from convenient centres and a back way, ample opportunity will be given for carting in rough materials for the base of the walk, and all manure and other such correctives, already described, as may be needful, all of which should be performed whilst the walks are in the roughly-prepared but unfinished state.

It is desirable, either by the aid of the soil removed from the walk-spaces, or by carting in good yellow fibrous loam from some pasturage, to afford more favourable root-soil to wall-fruit trees and tender crops to be grown at their base; and also so elevate these side borders as to give them a nice slope from the wall-base towards the walk. The roots of choice fruits planted thus on an elevation above the mean ground-level, always give increased favourable results.

Having planned out the main walks, which are essential to all gardens, not alone in matter of appearance but also practical utility, it will then be easier to observe whether any subsidiary or minor cross-walks are necessary. The fact must not be overlooked that an excess of walks deprives the garden of much valuable room, and that for main crops in bulk, goodly-sized quarters are needful. Besides, so-called alleys can be made at will, periodically or otherwise, according to the season, able crops grown and the cultural attention they require, be it more or less. The fact must not be overlooked that free access to all parts of the garden and all crops, both for culture and subsequent gathering, is of the utmost importance, especially during seasons of rain, &c., without which work cannot be done so rapidly and well, and the main walks cannot be maintained clean and in good order. Whilst, therefore, the main, open, and best quarters should be retained for the best main-crop vegetables, side-slips or irregular spaces, which exist in most gardens, are devoted to bush-fruits, such as currants, gooseberries, &c. The fact that an eligible sunny site must be set apart to the formation of a frame-ground, and sheds, to say nothing of sea-kale, rhubarb, &c., which should be contiguous to the frame-ground and the entrance whence manures are carted in, often causes such irregular slips, even where square spaces have to be dealt with. These are increased in instances where glass structures, pits, &c., all so desirable for winter work, are added to the whole.

Where the extent of wall is limited, surrounding ground can be utilised for this purpose, in the form of a "slip," or addition to the main garden. Whenever it is convenient to utilise a space of ground beyond the main garden in connection with the back entrance, it will be very advisable to do so on the score of neatness, as the crops last referred to,

when forcing operations are carried on, often cause much litter and untidiness around.

The vegetable garden would prove, apart from all considerations of necessity, of somewhat uninteresting contour without the addition of a limited number of trained fruit-trees beyond such as are grown against the walls. Thus, adjoining or skirting the walks, espalier trees should be planted, at about three feet distance from the two sides, with, if need be, a row of dwarf-trained or cordon Apples midway between these and the walk. Space so occupied reduces the main quarters considerably in extent, bringing them into convenient size for working. Either stakes or a neat iron-wire fence will be needful upon which to train such espaliers. Immediately on the inner sides, therefore, will be a suitable space for the formation of alleys, which are convenient both for the culture of the quarters and for training the fruit-trees. Frequently dwarf pyramidal fruit-trees are planted in preference to espaliers; and where dwarf cordons are dispensed with, such minor spaces are conveniently devoted to the growth of herbs, &c.

The width of the main quarters should in no case be less than twelve or fourteen feet; but if double this size it will be preferable. Wall borders are generally found to be of advantageous width when they equal the height of the wall. By this means, also, the roots of wall-fruit trees have an opportunity to extend in size, equal to the branches, when the latter reach the top of the wall.

Fruit-trees, on the above hypotheses, being very essential furniture in kitchen gardens, to carry out the matter very efficiently in all detail will necessitate special preparation or adaptation of soils to different kinds of fruits. Thus, for wall borders wherein Peach, Nectarine, and Apricot-trees are to be grown, the soil should consist of a porous loam, comprising one part sandy loam, and three parts sound fibrous maiden loam from a pasturage, well mixed together. Such a mixture or compost will prove ultimately, when manure of a good and well-decomposed kind is also added and forked into it, very excellent for early crops of tender vegetables and salads, to which reference is made under the proper headings. Apples, Cherries, and Apricots require a somewhat stiffer loam; in their case the sandy soil above referred to need not be added. Currants and Gooseberries delight in soil of a somewhat stiff nature also, but with a very abundant supply of manure intermixed.

Thus will different portions of the garden and varying aspects require such a variety of soils, for such furniture as described, as will, with foresight and care, within even a limited area, suffice to grow all descriptions of vegetables upon, on the lines or suggestions which will attach to each separate kind when treated of subsequently. In a few gardens, of course, especially such as are upon undulating ground, something in the way of such variety may already exist. Where this is not so, however, it is highly desirable, when forming the garden, to as far as possible give such variations.

Walks and Edgings.—Walks are an important feature, both from considerations of ornament and utility, but are more fully dealt with in separate articles.

The Cultural Treatment of the Soil during all subsequent time is a very important factor in connection with the maintenance of a garden in a highly fertile state. Arable or kitchen garden land, being in such an artificial state, must be employed in full activity, or this fertility cannot be maintained. It may not be overgrown with weeds; and to have it lying indifferently, even with the surface clean, is to engender sourness, owing to excess of humus within it. All parts therefore must, under such a system of culture, be turned up as soon as possible after the removal of any crop; the action of the air will thereby sustain its proper sweetness. Such parts as are under crops will in like manner be supported thus by the action of the roots.

In old gardens the surface soil often becomes poor, the roots of the limited number of kindred plants grown having deprived it greatly of the particular class of nutriment adapted to their own particular wants. Under these conditions a studied system of occasional trenching should be followed, in such manner that all large quarters devoid of fruit-trees and fruit-tree roots should be alternately dug and trenched to a depth of two feet, then to a depth of three feet, &c. Thus will the poor and most exhausted surface soil be deposited below; the bottom spit thereby placed upon the surface will contain new food for root-growth, and prove very advantageous to the crops grown upon it. Furthermore, such old worn soils as exist in these old gardens will be greatly aided by the addition of fresh loams. Such an addition, given in liberal quantities, would suffice, when properly mixed up with the older soil, somewhat in lieu of the supply of manure usually given at certain seasons.

Manuring or **Enriching** kitchen gardens must not be performed thoughtlessly and without judgment. The variety or quality of the soil in each separate garden should be well studied and treated. Its peculiar constituents indicate what is really necessary. Very light stony grounds, known often as "hungry grounds," are an exception to a general

rule. These cannot well have too much manure of any kind. Good loamy soils of moderate consistency should not receive such in excess. For this grade a moderate dressing often, is preferable to very heavy dressing at any time. Excepting in the case of the very light soils, previously referred to, fermented or thoroughly decomposed manures are always preferable, and they should be well divided before being dug into the ground, so that perfect mixing with the soil in process of digging or forking be assured. It is preferable, in connection with all areas under able culture, to dig the manure into the ground during the winter, or at least some time before the period for actual planting arrives. This can be better done, besides, in relation to the soil and its needful mechanical firmness, which has been treated of under its proper head previously. Some crops, such as Onions, Peas, Potatoes, &c., having the space prepared for them roughly during the winter, would also receive great assistance from a thin mulching of thoroughly decomposed manure scattered over the surface of the soil, immediately before the superficial forking up, which should invariably take place when seed-sowing is about to be done. Too much manure in any ground, it may be observed, finally destroys its mechanism, causes it to become soddened and sour, whilst giving increase to worms and innumerable minor insect pests. Certainly, a very dry hot season may correct this; but should a rainy one take its place, a loss of quantity, as well as a great lowering of quality, will result to all crops. Artificial manures are generally beneficial to all soils, especially during rainy seasons. It must not be overlooked, however, that they do not possess the moisture-retaining power, with the root-food-in-readiness capacity, which all stable manures retain, even during arid periods, and when of so great import to all crops.

THE CULTURE OF VEGETABLES.

Bean, Kidney Dwarf (*Phaseolus vulgaris*). French, *Haricot;* German, *Bohn;* Spanish, *Frijorenano.*—The Dwarf Kidney Bean, often improperly called "French Bean," a tender annual plant, introduced from India, is one of the most productive and useful within the range of cultivated plants used for food in a green state. Requiring little culture, provided the land is well drained, moderately light, and enriched, it produces heavy crops of its seed-pods on dwarf plants grown very closely together with very limited attention. This species is so tender that the slightest frost will injure or destroy it. For this reason it should not be sown or planted before the end of April, or the first week in May; the object being to defer germination and subsequent growth until perfect security against late spring frosts exists. Such late frosts often occur on May 18th to 20th; sowings made as above will therefore escape them.

So valuable is this crop, however, that sowings are made in pots or boxes, and the plants grown on therein to the third leaf by the latter date named, when they are transplanted into favourable sites for fruiting; such a favourable site being one on the southern aspect of wall or fence, having protection from east winds. For the earliest crop the soil cannot be too light and dry. Later or summer sowings succeed better in somewhat stiffer loams and more exposed sites. The seeds should be sown in rows two feet apart, the seeds to be two inches apart in the row and two inches deep.

So soon as the seedlings appear above ground and begin to form the third leaf, well mould them up on both sides, by drawing an equal quantity of soil to each, after having first well hoed between them. The only subsequent attention they require is an occasional hoeing between, an operation which should not be undertaken whilst the plants are damp either with rain or dew, as they are very susceptible of injury from bruising, and most so at such a time.

For successional crops, sow more rows according to demand, immediately preceding sowings are well above ground. The last sowing should be made not later than the first week in August. The two best sorts are Canadian Wonder, strong, tall, and mid-season, and Negro, which is a very prolific one and dwarf.

Dwarf French Beans force well, and are generally utilised in this manner where convenient glass structures exist. The practice is to sow three or four seeds in sixty-sized pots to the number requisite. First crock and three-parts fill each pot with turfy loam and leaf-mould, or decomposed manure; press it down firmly, drop the seeds thereon, and cover over with more soil an inch or two deep. So soon as germination takes place, and the young plants appear above ground, place the pots near to the glass in a light place. When the third leaf is formed, procure large thirty-two or twenty-four-sized pots, three-parts fill with similar soil, but more turfy or in lumps, and firmly plant the young plants therein, without in any way breaking the ball of soil, or injuring the young roots. Tie each plant separately to a stake, and keep freely watered and syringed overhead, maintaining a moist temperature of 60° to 75°, with air as freely about midday as possible. When flowering takes place and pods form, give manurial waterings alternately. The variety named Newington Wonder is adapted for this purpose.

The crop is greatly enhanced, both natural-grown and forced, by early and regular gathering of the pods. It is an error to defer this until such times as the produce is actually required for use, the result being anything but tender vegetables, which, growing too long, tax the plants and limit the after-supplies beyond what can be imagined. As a novelty in this class, the American Black Wax, or Butter Bean, possessing yellow, waxy, transparent pods, is appreciated by some people. In the same category may be placed the White Marrowfat, for use in the shelled state, both green and dried.

The best modern varieties are: Canadian Wonder, Fulmer's Monster, Negro, Ne Plus Ultra, and Sion House.

Bean, Runner (*Phaseolus multiflorus*). French, *Haricots à Rames;* Spanish, *Judias;* German, *Stangen Bohne.*—The Runner, Climbing, or Pole Bean, known commonly as the Scarlet Runner, is a native of South America. The name "Scarlet Runner," though intended to be explanative, should cease to be used, if but from the fact that a white-flowered variety—known as the Dutch Runner—is more or less grown. A sport from the former also gaining favour amongst growers, having parti-coloured blooms, is named Painted Lady.

Dwarf French Bean, Ne Plus Ultra.

The Runner Bean, as its native habitat suggests, is not so tender as the Dwarf Kidney Bean, though it cannot withstand the injurious effects of more than two or three degrees of frost. Both as a garden and a field crop it is very general, its pods being highly nutritious, and appreciated, owing to a peculiar roughness they possess on the palate. It will never, however, take the same place in universal estimation occupied by the highly succulent and tender Dwarf form.

Though the plant is hardier than is the Dwarf, the seeds, nevertheless, are more liable to rot when placed in the ground; for which reason, rather than from any other, sowing is deferred until later than is always necessary. In light sandy soil this consideration is not so important. A light sandy loam, and deep, is most suitable to it. When sown in such soils as are naturally damp and tenacious, it is an excellent plan to place a little dry ash in the trenches or holes along with the seed at the time of sowing. To neutralise the effects of too much latent moisture in the soil, it should be dug up during dry weather, a short time only before seed-sowing, digging in manure of any kind freely. On any consideration such late sowing as is often practised is not desirable. Even should the young plant push through the ground, and in its seed-lobe or most tender state receive injury, the seed below has the power to push forth duplicate growths, which often prove more productive than the earlier one.

Two distinct systems of culture are commonly practised, *i.e.*, pole and dwarf culture. In the former system the young plants have poles or high sticks to climb upon; in the latter, without such aids, the plants are kept "stopped," the young growing shoots being cut off as quickly as any are seen to form. This last method is employed in connection with all field culture for market. The result is, crops are much earlier and more abundant, as many more plants occupy a given space of ground, the whole strength of each plant being thrown into flower and pod formation. In due time this method will entirely take the place of pole culture.

For pole culture, parallel rows should be four feet asunder. Place the seed in drills, two inches deep and four inches apart, scattering some kind of dry material over them, and draw the soil lightly over them. This might be safely performed on May 1st to 5th. When germination takes place, and the plants are well above the ground, mould them up deeply and well, place the poles to them, using care not to injure the roots, and place a row of sawdust, bran, barley awns, or wheat chaff all around, to deter slugs from injuring them, which they invariably do, if not prevented. When the plants are about three feet high, pinch off their points.

With dwarf culture, sow the seed in a similar manner, and at a similar date, three feet asunder in the rows. Mould up the young plants so soon as the third leaf shows. Immediately a shoot is seen to spring forth from amongst the young leaves, take its head off, and as fast as duplicate shoots or laterals form, treat them similarly. Do not neglect to do this throughout the whole season of growth. The handiest way is to walk along the rows with a sharp long-handled knife, and to behead each with a swing of the knife. To secure successional crops permanently, it is desirable, after pods are once formed, to gather such as are fit for use twice a week; indeed, if the pods are left any time ungathered it destroys their edible qualities very materially. The full summer culture consists solely in preventing weeds from growing amongst the crops. By keeping them well hoed during the month of June, however, little outlay of labour beyond is requisite.

White Beet.

With regard to varieties, the old scarlet-flowered, and white-flowered Dutch, are of equal merit. Painted Lady is slightly more tender than either. There are improved, longer-podded varieties of the two former in commerce, viz., Scarlet Champion, Princess (a stringless variety), and Mont d'Or, the Butter Bean, possessing yellow pods.

Red Beet.

Beet (*Beta vulgaris*). French, *Betterave;* German, *Runkel Rube;* Spanish, *Betteraga.*—Beet, a name derived from the Celtic for red, in reference to the colour of the roots of this species, is nevertheless the name in use also for the white species, to which reference will be presently made. It is a vegetable root of some moment, both for comestible purposes and for the manufacture of sugar—an industry, now that science has found means to eliminate certain objectionable adherents to its saccharine properties, likely to be greatly increased.

Its culture is both simple and easy upon soils suited to it. These consist of such as are light and sandy, which should be well dug up during the autumn months, and left roughly exposed to the influences of frost during winter. At the time of digging, place a good layer of manure about eight or ten inches deep. This is easily done by deep and clean digging alone. A good open trench should be kept, and after each spitful, manure should be placed in the bottom from whence each is taken. Early in the month of May of the spring following, the space should be lightly forked over in such a manner as not to interfere with the manure below. In doing so, break the soil up finely and level it neatly. A dry period should be chosen for this operation. Drill sowing is the mode best adapted. The drill rows should be from nine inches to a foot apart, and two inches in depth. The seeds, which are somewhat large, should be dropped into the drills at distances of about three inches apart, so as to insure a "good plant." When the plants have attained three or four leaves, thin them out in the rows to six or eight inches apart, dibbling in an occasional strong plant which has been removed in process of thinning, into all vacant spaces, should any seeds happen to have failed so as to occasion such. From thence, throughout the whole of the summer months, give such periodical hoeings as will suffice to keep the soil loose and fresh, and thoroughly eradicate all symptoms of weeds. Great care must be taken during the hoeing not to cut and so injure the sides of the roots which are forming, not an infrequent occurrence when clumsy workmen are employed.

It is important to take up and harvest this crop before any symptoms of frost occur in the early autumn, else will danger of actual injury exist, and

the roots besides become harder, or more fibrous, and less tender when cooked.

In taking them up out of the ground, great care must be used not to wound or break off any of the roots. Each root should be separately lifted with a five-tined fork, taken up in the hand, divested of all soil by the aid of a blunt stick, the leaves being then twisted off with the hands in a manner not to injure the crown—they must not by any means be cut across with a knife—after which they are carefully stored away for winter use. Modern varieties are greatly improved both as regards colour and quality, the form of the root being excellent in some instances. Such varieties are those known as Pine-apple and Nutting's Red. The Egyptian Turnip-rooted variety is also a very excellent type. Being in the exact Turnip shape, it is better suited to shallow grounds than are long-rooted ones.

Beet, White (*Beta cicla*). French, *Poirée*; German, *Mangold Kraut*; Italian, *Biettola*.—The Great White, or Sweet Beet, is cultivated mainly for the midribs of the large and ornamental leaves, which, with the green portion (*lamina*) removed, are cooked and served, under the name of Chard, in the same manner as Asparagus. The ordinary White Beet, which also possesses more abundant and larger leaves than the Red Beet, is grown for the leaves, which are used in soups, and in the same way as Spinach. A generous culture is desirable in connection with both varieties. Small beds only are needed as a rule. Sowings may be made broadcast during both March and September, thinning the plants out to eighteen inches apart. Delugings with water are beneficial in the summer months. The leaves are occasionally appreciated more in the way of the Chard by being somewhat blanched, which is easily done by placing between and among them, to a third or more of their depth of leaf-growth, dry fallen tree-leaves, &c. The frequent gathering of the outside leaves will induce the plants to form others of a more tender and succulent kind the more quickly.

Broccoli, Early White.

Broccoli (*Brassica oleracea*, var. *botrytis*). French, *Chou brocoli*; German, *Spargel-Kohl*; Spanish, *Broculi*.—The Broccoli may be described as a hardy form of Cauliflower, and one which, owing to the climatic influences derived from its native country, and the natural period of flowering there, adheres to its practice of flowering to date (whether that be midwinter or spring, judging the seasons as experienced) here. Originally imported from Cyprus towards the end of the sixteenth century, other forms in duplicate were received from Italy somewhat later. Being hardier than the Cauliflower, and capable of withstanding the sharp frosts of our winters, especially now that such excellent white-flowered forms exist, it is one of the most valuable and reliable vegetables. It requires and deserves generous culture. A somewhat stiff heavy soil suits it the best, having a moderate supply of good manure intermixed therewith.

In view of securing a successional supply for a lengthened period, commencing with the month of October, and continuing onward throughout the winter until about June of the following year, it is necessary to grow several varieties and to sow the seeds, plants, &c., at different seasons.

Seeds of the following varieties have to be sown early in the month of April upon a warm sunny border, viz.: Snow's Winter White, Walcheren, and Grange's for autumn and winter use. Dilcock's Pride, Penzance, Miller's, and Wilcove's during the third week in March for a later or early spring and early summer supply. The seeds should be sown on well-manured, finely-raked and broken-up ground. Sow them broadcast, and simply draw the rake to

and fro over them. So soon as the young seedling plants are well above ground, prepare a space for them in an exposed part of the garden, by digging it up deeply, after having first placed a layer of manure over the surface. It is well to dig the ground thus early, to give it time to settle down somewhat before planting. In the case of very light soils, it is preferable to dig them up in the autumn, and to subsequently only hoe over the surface at the time of planting.

So soon as the plants are large enough, having formed five or six leaves, carefully draw them from the seed-bed, after having first loosened up the soil with a fork; choosing the larger plants only. By leaving the smaller plants in the seed-bed, giving them a watering should the weather prove at all dry, and making subsequent plantings of them as they become large enough, a successional crop will be secured. When a very large and very constant supply is required, it is customary to make successional sowings during the month of May. For all ordinary purposes, however, the sowings and transplantings recommended above give an excellent supply. A much coarser variety of Broccoli, used chiefly as a "green" during the winter months, or before flowering has commenced, is the Purple Sprouting. It has precedence over most "greens" in the metropolitan markets, and is considered to be worth growing; the treatment above given is suitable to it.

Plant all three feet asunder between rows, and at least two feet between plant and plant in the rows. Broccoli is often planted more thickly than this, but it is at the expense of a good crop and the maturing of the plants so that they are capable of withstanding severe wind-frosts. The summer culture following planting, consists in simply moulding the plants up when active growth commences, and in so hoeing amongst them subsequently as to prohibit all weeds from growing. The autumn and winter varieties will require, during all sharp weather, to have a little loose litter placed between the plants and slightly over the crowns, if they are at the blooming stage and the weather increases in rigour. It will be necessary also occasionally to examine the plantations, picking out such as are well-hearted, drawing the whole plant up for use, or to hang in a cool place until required for use, beyond reach of frost. The later spring kinds are often advantageously laid on their sides at the approach of winter. This is known as "heeling in." A spit of soil is removed from the more northward side, and the blade of the spade is then inserted on the other side and forced over, so as to cause the head to fall over to northward, the object being to lay it on its side towards that aspect without greatly injuring the roots, soil being placed over them to give them and the stem additional protection.

The following, some of which are referred to above, are desirable varieties:—

For autumn use:—Backhouse's Protecting, Grange's Cauliflower, Snow's White and Walcheren.

For spring use:—Adams' Early White, Chappell's Early White, Cooling's Matchless, Dilcock's Bride, Leamington and Penzance Early White.

For late spring use:—Cattell's Eclipse, Monarch, Goshen, Miller's Dwarf White, Model, and Wilcove Improved.

GARDEN-POTS AND POTTING.

POTTING PLANTS.

SO vitally important is judicious potting to cultural success, that it can hardly be too carefully or fully treated. Unfortunately, like a good many more operations in gardening, it can hardly be fully taught in books. The art may be minutely described, but the practice not fully taught by words or illustrations. Nothing seems more simple than the shifting of a plant out of a small pot into a larger one, but in reality no operation within the whole range of horticulture is more complex, or complicated by a greater variety of side and main issues. To attempt to grapple with all these would only bewilder the uninitiated, and provoke the opposition of not a few good cultivators. But a few of them must needs receive a passing notice.

The pots themselves are the first disturbing element, inasmuch as they are very far from being of one uniform quality or thickness. Some of these will absorb, others evaporate, double the amount of moisture through their sides that others will.

And then the roots of plants are as infinitely varied in their structure, character, and wants, as the tops are in their modes of growth, forms of foliage, colours and shapes of their flowers, and qualities and sizes of their seeds or fruits. Yet, not a few go on potting plants as if the roots were wholly or almost all alike.

Then, again, the soils of no two gardens, nor the peats, loam, nor sands from any two places are ever exactly alike. The disturbing power of sand alone in composts is incalculable. *This* is pure silica, as nearly as may be; it acts mechanically, as a good sand should; *that*, which looks so pure and white, is largely impregnated with salt, lime, or white clay.

Then take the different degrees of solidity in potting itself, which are about as variable as the number of potters, since no two men ram the earth round the sides of the pot or the roots of the plant with the same force.

But it is hardly necessary to suggest the difficulties of perfect potting at any further length. To be forewarned is to be forearmed; and these are named to promote care and caution, and not to produce timidity or lack of confidence, as expert and firm handling are among the first qualifications for good potting.

Dibbling in.—This phrase is almost confined to the insertion of cuttings. These are invariably put into hard sandy soil surfaced with silver sand, with a small sharp-pointed stick from three to six inches long, called a dibber, or dibbler. This tiny stick is as

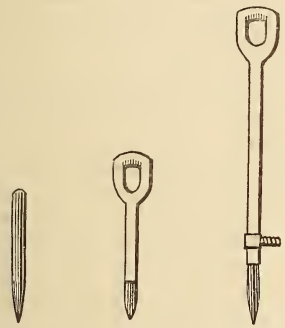


Fig. 12.—1, Small dibber for pricking off seedlings or putting in cuttings; 2, common garden dibber; 3, Potato dibber.

unlike as can well be to the common dibber, formed of part of a spade-handle, used for planting Cabbages, &c., or the foot-dibber, mostly shod with iron, used for the insertion of Potatoes, or other seeds. It however gives its name to the operation of inserting cuttings, and is, in fact, the only possible way of putting them in properly. The chief art in dibbling is to make the cutting, or seedling, solid at its base. Many dibble all their lives, and never learn that simple art. They concentrate all their efforts on making the stem or the surface firm, which the first watering will do better. Make the base firm, and all will be well with the cutting; leave it loose, and the very firmness of surface or of stem often suspends it in the soil, leaving a vacuum at its base that is fatal to its forming roots.

Washing in, or Flooding Home.—On the heels of the dibber comes the fine-rosed watering-pot. The rose can hardly be too fine for small cuttings, as a heavy shower would displace rather than further solidify the cuttings. It needs considerable patience and skill to flood cuttings in. Continue to pour the water on steadily till the whole surface is flooded; then leave the pots where watered until the water subsides. In cases where extra solidity is desired, a simple mode of obtaining it is to gently tap the pots on the bench, keeping them quite at right angles with it, just as the last of the water is disappearing. This operation needs careful timing and execution, as otherwise it may disturb the cuttings, and do more harm than good. When the pots are properly prepared and filled with the right compost, surfaced with sand, the tapping while wet is better dispensed with, unless done by skilful hands.

Pricking off or out.—These terms are applied to the removal of small seedling plants from their seed-pots, pans, boxes, or beds into others, to develop their strength and multiply the number of their roots. It is also used for very small cuttings, though not very often. In a general way, the term and the practice are applicable to all plantlets that need thinning, and are not sufficiently advanced to have a pot or separate growing-space allotted to them. Hence, all the Cabbage tribes, and such vegetables as Celery, are pricked off their seed-beds into others, and placed at distances of from two to three or four inches apart. These are called nursery-beds, as from these the plants are finally transplanted into their growing quarters. This example will make the meaning and the use of pricking out obvious.

The idea of nursing runs through the whole. The plants support each other, and tender and delicate plants, after pricking out or off, should have almost as genial treatment as cuttings (see PROPAGATION) until re-established.

As to time for pricking off, so soon as they can be handled, is the usual rule for attending to this, and in this case it is absolutely right, as well as the very essence of common sense; for it could hardly be done earlier, if we would, and the earlier it can be done the better. Another rule with many plants is, so soon as they develop a third, or more correctly speaking, one proper leaf; for the two cotyledons are rather rudimentary appendages to the embryo root and stem—that is, in botanical terms, the radicle and plumule—than proper leaves. That they cannot be trusted to perform the functions of the latter is proved by the disappearance (by withering up or falling off) of the cotyledons soon after the appearance of proper leaves. Hence the vital importance of waiting for one or more of the latter before pricking off young plants.

Important as this operation is, it may often be rendered unnecessary by thin sowing, and plants specially impatient of disturbance in a young state should be sown so thinly as to enable them to stand

in their seed-beds, until sufficiently large to be placed singly in pots, or in their growing quarters in the open air. In regard to the latter, the best and safest way with many plants is to sow the seed in their blooming and fruiting quarters. Washing home, or establishing the plants in their new quarters, is almost as important in regard to pricking off as to dibbling in.

Potting off.—This term is applied to the removal of cuttings and seedlings from their rooting nursery or seed-bed into single pots. The process is somewhat analogous to the promotion of a child from the nursery to the schoolroom. After potting off, the plant must stand alone to some extent, and has to thrive or fall by itself in its own pot or space: from being one of a mass, it is made an independent individual, and great care is needed in the first potting off. In seed-pans and nursery-beds the roots of different plants get very much mixed. The evil is aggravated by the plants standing too long and being placed too closely together. The process of root disentanglement is difficult and dangerous. The delicacy or the brittleness of the roots of many plants causes not a few breakages, bruises, and many severe losses of roots. The best way of preventing these is by potting off early. So soon as fairly rooted, pot off.

Size of Pots.—These can hardly be too small, provided they are of sufficient area to receive the roots without bending them back upon themselves or twisting them round. The plants should be lifted out of their nursery quarters, each with its roots and the ball of earth into which they have run intact.

The best way of insuring this is to slip the fingers of the left hand carefully under and through the plants, so as to retain them in the mass and form in which they are growing. Invert the pot, give it a gentle tap on the potting-table, or bench, to loosen the pot from the compost; remove the pot or pan, and carefully place the plants without the pot in their original positions. Then, with or without the aid of the small pointed stick or dibber already described, begin at one side, and carefully separate the plants, retaining as much soil as may be to each. With more common plants, it is a common practice to return the plants to the bench with a sudden jerk, which will break the nursery-soil or ball into fragments, each retaining its plant; or the ball may be divided through the centre, and each plant separated from its neighbour by the skilful manipulation of practised fingers.

The potting off of each plant into a single pot must proceed as rapidly as possible until all are finished. It is very important in this first potting that the roots should be carefully distributed throughout the compost. For example, the pots are often filled probably two-thirds or more with drainage and compost before the plants are inserted, and if carelessly potted, the whole of the roots will be huddled together in that particular plane; whereas, skilfully handled, the placing of the roots and filling in the earth around them will be so timed and correlated that almost every bit of soil will have its roots, and no two roots will lie together or touch each other. Thus, when growth is renewed, every root will find its own food within easy reach of it, and the entire mass of earth, large or small, be utilised and filled with vigorous roots within a mere tithe of the time that it would have taken them to do so under careless cramming in and the absence of a painstaking disposition of the roots.

Neither will it be needful at this first potting off to compress the soil so firmly around the roots as in any future pottings. At this stage not a few of the roots will probably be found detached from the soil, and of a soft and brittle character. Any undue pressure, especially in a new mass of earth of a very different degree of solidity to that from which the plants have been just removed, would, of necessity, injure the spongioles or mouths of the roots that will very generally extend beyond the balls; and as it is on these that the well-being or even life of the plant depends, it is of the utmost importance that these should start fairly and freely into the new soil. As the mass of soil in the pot is in most cases of potting off so very inconsiderable, and will be so soon filled with fresh roots, this loose potting off—the word is used relatively in relation to other pottings, and not absolutely—proves to be the better way.

Besides, as potting off should always be succeeded by a good watering home, and water is the great consolidator of soils, the roots will find their new home sufficiently solid for their well-doing.

A little extra nursing proves most useful after potting off. If the plants could be returned for a week or ten days to the fostering atmosphere of their nursery quarters, it would prove the best thing possible for them. The danger period of all plants after potting off, is that measured by the period of their detachment from the soil. So soon as the roots grip hold of the new earth or compost, that moment, under ordinarily fair treatment, the health and life of the plants are secured.

Shifting, or Removal into Larger Pots.—This is what is emphatically called "potting." Hence, in practice, "Pot that plant" really means, give it a *larger* pot—that is, more room for its roots. Repotting, however, sometimes in practice comes to just the opposite of this, and the experienced potter

in shifting his plants determines his course by root-condition. If that is good, vigorous, and obviously cramped, he gives a larger pot; if otherwise, he not unfrequently puts it into a smaller one. There is no resuscitating process so prompt and effectual as this in the case of many plants. Worms, bad drainage, indifferent or unsuitable soil, unskilled watering, may have converted the root-runs into quagmires of sour, putrid earth, in which the roots are sickening towards death. Remove the whole, wash the roots clean if needful, as it often is, and re-pot in very light, porous, sandy soil, or fine sand, placing the roots in the smallest possible pot, and give such extra nursing as advised after potting off, and the roots may be re-established in health and quadrupled in numbers in a few weeks, and the plant saved. So soon as this renovation is effected, the plant may be re-shifted into a larger pot, and treated as advised for others.

The time for shifting plants must be determined by condition, and with but little reference to the calendar. At one time, however, the spring and early summer months were mainly devoted to the potting of plants. This was carried so far that plants were shifted in April or May, whether they wanted it or not. No doubt these general pottings at such seasons suited the majority of plants; hence the practice survives to this day.

Accepting as an axiom, that no plant should be pruned and potted at the same time, whatever its condition, as such a double check hinders alike the formation of roots and the growth of top, there are three general conditions of plants favourable to their re-potting or shifting. The first is soon after starting; the second, in the middle of their growth; and the last, just before their growth is ripened. And these seasons, determined by condition, apply to all plants without exception, whether hard or soft-wooded, herbaceous or bulbous, exogens or endogens.

Soon after starting, then, the bursting buds and growing shootlets, overflowing with vital energy, and having organisable matter enough and to spare to supply all their local needs, are able to spare a good deal of both to stimulate a freshly-disturbed root into immediate activity—a point, as we have already seen, of the utmost importance to the health and strength of plants. Nor is this all; hardly have the roots been assisted by the growing tops to run into the fresh composts, than the tops begin to draw upon them for supplies, and this keeps them hard at work. And these compound actions and reactions of the growing tops are the great quickeners and sustainers of root-activity, and this is the foundation of robust health and plentiful produce.

During the middle of their growth is also a capital time to shift plants into larger pots. As the strain upon them for the development of more and larger leaves or flowers increases, and their many roots have ramified through and exhausted the soil, this is the time to add a fresh supply. If this is withheld the spongioles, or root-mouths, that have been hugging closely and trying their strength in piercing through the sides of the pots in search of pastures new and richer in which to feed, are apt to become shrivelled up and exhausted. And plants can no more feed themselves without these open mouths than a gardener can pot plants without hands.

Finally, just as the ripening processes are well-nigh completed is a good season to pot or shift plants into larger pots. At that season the growing energies of the plants seem to gravitate rootwards. During the growing season the roots have ministered chiefly to the other parts of the plant. Now they are about to come in for their share, and hence the necessity of enabling them to make room to receive the rich stores of growing force which the vital and chemical action of the aërial portions of plants, aided by the ministrations of sun and air, rains, dews, and other agents, is enabled to send them.

As a matter of observation and experience, the ripening time above ground is a season of abnormal activity and rapid extension of the roots under ground. The vital forces change their course rather than lessen their energy, in the so-called "rest" of golden autumn-tide. Hence, we find that towards the close of the season of maturity is one of the very best times for the shifting of many plants.

It is needful, however, not to misapply these general principles. They are applicable to the very letter to such plants as, for example, the Camellia. So much is this the case that hardly any two growers agree as to the best time to pot these plants. And this, not because doctors differ so widely, but rather that it matters hardly a feather's weight to the plant which season is chosen, or whether, in cases of exceptional vigour, all three are in succession, and within the compass of six or nine months.

Other points that may interfere with or alter the time and mode of potting, are the character of the plants, the purposes for which they are grown, and, as already hinted, the condition and number of their roots. No one would rigidly adhere to the same rules as applicable to what may be termed permanent and transient plants. Annuals and biennials would be potted for different objects and purposes to triennial and other plants. For example, a Balsam or a Cockscomb might need potting once a month, while for a slow-growing Heath, a shift once in two years might be almost too frequent.

Purpose, again, largely controls potting times and modes. In foliage plants, such as Anthuriums, Marantas, Crotons, Caladums, Ferns, Palms, grown

for their foliage, the times and methods of potting will be different from those applied to Clerodendrons, Stephanotis, Dipladenias, Heaths, Epacris, Leschenaaultias, Azaleas, and other flowering plants. As a general rule, foliage plants should have more frequent and larger shifts than flowering ones. Growth is thus fostered and encouraged, and that is all which is needed, or nearly all. In flowering plants maturity, perfect and complete, must be secured as the basis of free flowering, even among soft-wooded plants, like Fuchsias, Pelargoniums, and others; over or unseasonable potting is fatal to free and perfect flowering. In plants grown in pots for their fruit, such as Strawberries, Figs, Peaches, Grape-vines, the correlation between pinched, cramped, pot-bound roots, and fertility, is even more indissolubly united. But, of course, after all, the state of the roots is the best index as to when and how to shift or pot plants. So long as there is much soil left unoccupied on the outer circle of earth in contact with the pot, and few roots are visible, the plant does not need shifting. "But how can we know that?" novices in gardening may well ask. By simply turning the plant out of its pot, and holding it on the palm of the hand, removing the pot from the earth. The earth-works, the ball of the plant, and the state and condition of the roots are thus laid bare. Should it need potting, proceed as directed in the next section, and shift it into a larger pot. If not, return it to its pot again, taking particular care to place the pot over the ball in the exact position in which it was before removal; for hardly any pot is exactly round, and as the pot has moulded the ball—as the earth and roots within it are technically called—to fit itself, they must occupy the same relative position as before. Very trifling instructions to give—yes; but the neglect of them leads to the disease or total loss of the plant, as it opens up a nearer and quicker exit for water through the interstices by the edge of the pot than that by slow percolation through the ball, the only watercourse through which the plant can be preserved in health.

The Actual Process of Potting or Shifting.—This is not a simple but a compound process, and brings us into direct contact with pots, crocks, composts, roots, balls, various methods of procedure, and after-treatment of the plants. As regards the pots, they must be clean, dry, and sound. Nothing is more injurious than the use of dirty pots; they contaminate the soil, and poison the roots almost as soon as these are placed in them. Wet pots are almost as mischievous as dirty ones; the outer portion of the compost sticks to the pots, deranges the action of the drainage, and interferes with the free passage of water through the new mass of soil. On the other hand, new pots, especially when used in summer, are often too dry, and should be steeped for some hours before using, allowing them, of course, to become dryish again before use. Otherwise, new pots of certain makes in dry weather often drain most of the moisture out of the compost, to the impoverishment of the roots.

Unsound pots are not only unsafe to handle, but dangerous for the roots in other ways, and should never be used. As to the sized pots to use, the word "cast," applied to pottery, is most suggestive, and the old practitioners mostly advised an *inch* at a time during the smaller stages, advancing to two, three, and even four inches as the sizes enlarged. The one-shift system, which we purpose describing, altered most of this, as it leaped at one bound from a two or four-inch to a twelve or eighteen-inch pot. Still, for a great many plants the progressive system of potting is the best, and it is still the general practice to advance in size tentatively. It is also the safest. The successful exhibitors of prize stock feed often, and remove all that is not eaten shortly after feeding. This sustains the appetite at a higher pitch than any other method. To some extent progressive shifting by easy steps does likewise. Only a little food is given at a time, and hardly is that consumed before the roots find a fresh supply provided for them in a new or clean sweet pot. And provided the food is agreeably sweet and tempting, the roots speedily plunge into and devour it. It has hardly time to become stale before it is used up. The pots must also have one or more holes for the free removal of water. And this brings us to crocks, which, whatever the origin of the word, here simply mean drainage in the bottom of the pot, no matter of what sort. However, there is nothing better than broken pots, potsherds, bricks, shells, or charcoal. Even freestone or sandstone is almost too heavy to form good drainage.

Place over the centre hole of the pot, or against the three holes round the sides of the bottom, a piece of potsherd two inches or so over. This should be laid tolerably flat, so as to help to exclude worms, but not too much so, lest the exit for the water should get silted up. Over these place a layer from half an inch to four inches, according to the size of the pot; the larger the pot the more drainage, and the coarser it may be. A better way of crocking larger pots consists in placing an inverted small one over each drainage-hole, and filling up part or the whole of the way between, with rough crocks or other hard materials. Pots so treated render the ingress of worms and other pests almost impossible.

But this drainage of pots, while chiefly mechanical, may readily be made manurial as well. This is done by using such substances as oyster and other

shells, smashed bones or charcoal, hoof or horn shavings, or other hard substances more or less rich in manurial properties. By using such substances for drainage, the whole contents of the pots become available for feeding the plants.

Over this harder and more durable drainage material, there is mostly placed a layer of sub-drainage of softer matters, such as moss, partially decomposed bones, cocoa-fibre refuse, hard dry manure, the rough fibre of peat and loam, half decomposed and semi-baked turf, &c. The main use of these is to keep the drainage clean and efficient, by preventing it from being silted up by the finer soil. They form a wall of separation between the compost and the drainage, and so preserve the quality, and minister to the performance of the proper functions of both.

As these intermediary drainage materials decompose they also become good food for the roots. But before they are wholly consumed, or their powers broken by the latter, the plant will probably have been shifted into a fresh pot; or, if not, the roots will have increased to such an extent as to form a perfect barrier between the compost and the drainage.

Compost.—The matter of composts is a vital one to perfect potting. The bases of all composts are sound turfy loam and fibrous peat, with slight additions of leaf-mould, cocoa-fibre refuse, charcoal, and sharp gritty sand. Silver sand is preferred for nearly all plants, inasmuch as it is almost pure silica, whereas most of the coloured sands are largely impregnated with oxide of iron, loam, or clay, all of which are injurious to delicate roots. Some of these impurities can be got rid of by washing, but others enter almost into the very substance of the sand. Hence, where silver sand cannot be obtained, smashed Bath-stone or sandstone is probably the best substitute. But silver sand has now become such an important article of commerce that it can be had everywhere, and no better horticultural investment can be made than that in a ton or more of pure sand before wanted, as more poison probably enters into composts through the sands added to them than by any other way. A few sacks or tons of Norwood loam, and as many or more of peat, from those experts who make a speciality of the selection and supply of these, will answer the purpose of every grower of choice plants.

The ignorant will say loam is loam, and peat is peat, and what is the use of having either from a distance? But the difference between these is often so great that one kills, and the other grows plants to perfection. Many years ago the writer had half a dozen loads of peat presented to him; it looked good, and handled and smelt well, but within less than three years a promising collection of Heaths were dead, and scores of Azaleas, which are far less particular, in a bad way. The peat was killing the latter, and had killed the former, though the cause of its doing so remains a mystery to this day.

For general potting purposes, half and half of peat and loam, with from a sixth to a twelfth portion of pure silver sand, forms the orthodox compost. Of course, Heaths and other hard-wooded plants with hair-like roots should have peat and sand only. There are also peats and peats, and the harder and more gritty the peat, the better for these. But here only general principles can be laid down and general rules given, as under the heads of special culture of different genera, such mixtures as that of white sphagnum crocks and charcoal, which suit the growth of Orchids, and other special combinations that form the most suitable composts for particular species, will be adverted to. Some of these plants are not potted at all in the ordinary meaning of the word. The fleshy roots of Orchids push through, or overrun their composts, rather than live upon or out of them, absorbing little more from the compost than they do out of the atmosphere.

After all that can be said on the subject of potting or shifting, the time, manner, and extent of it must be mainly determined by the state of the roots. Returning for a moment to our plantlet potted off for the first time, so soon as the roots reach and begin to run round the sides of its first pot, it ought to be shifted into a larger one, and so on in succession through all its future-sized pots. This would prevent one of the greatest dangers and difficulties that plants in pots have to contend with, that of the matting of the roots.

This phrase explains itself: the roots get crammed together so tightly, and interlaced so much, as to resemble a plaited straw or other mat. Once plants become badly matted, the roots are difficult to deal with. It was this difficulty that suggested the barbarous practice once so common, of cutting off most of the lower portion of the roots at every successive shift or potting. The stronger and more iron-like the roots, the more it was resorted to, until the disrooting of such plants as Pines and Palms, and not a few vigorous-rooting Ferns, became about as common and as orthodox as their shifting into larger pots.

It is now, however, generally recognised that prevention is better than cure, and the only sure and certain prevention of root-matting is timely potting. This will check that spiral course of the roots which exaggerates so greatly all the evils of matting. For if once roots are permitted to overlap and interlace each other in this way, there is hardly any possibility of unwinding without breaking them.

Still a good deal may be done by caution and skill in this direction. Having turned out the plant on one hand, as already described, with a sharp-pointed stick in the other, proceed to pick away the crocks from the summit of the root-mass or ball as now inverted, and disentangle, as much as may be without breaking, the roots, at the same time picking and shaking away as much of the exhausted soil as may be done with safety. During this careful and minute examination of the roots the whole state of the plant will be revealed. Before it is completed the cultivator will have been provided with all the data needed to determine the size of shift he will give.

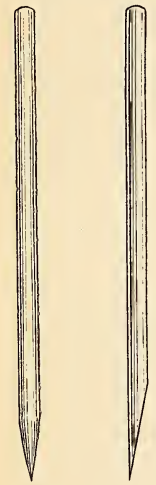


Fig. 13.—A, Sharp-pointed potting-stick two feet long; B, potting-wedge for ramming soil in firmly between pot and ball.

Estimating the growing force of the plant, and taking into account the purposes for which he is growing it, he will give it a small or a large shift accordingly. From one to three inches would be counted a small shift for a large plant, from three to six a large one.

The smaller the shift, the more difficult the work of good potting. Where the fingers cannot penetrate, a potting-stick, and a sort of wedge-shaped dibbler (Fig. 13), become indispensable. The drainage, sub-drainage, and bottom parts of the compost are all placed in the pot. These should be nicely arranged, placing the larger and rougher portions of the compost over the sub-drainage, and pressing all down firmly with the hand or hand-rammer.

Place the plant to be shifted in the centre of the pot, and see that the surface of the balls stands from half an inch to three inches, according to the size of the plant, beneath the top of the rim. Of course the larger the plant the deeper the space, and *vice versâ*. This is the water-holder, and unless it is ample, no firmly-potted plant can thrive.

From this point proceed to fill in the sides, working the compost in among the roots with the potting-stick and hands, as well as firmly filling the space between their extremities and the inner edge of the pot; here the wedge will be found necessary. Perfect potting in this phase of it means perfect filling, and when completed, not an atom of space should be left vacant, and the roots should as far as possible be equally distributed throughout the entire area of the compost in the pot.

State of the Compost.—It is impossible to finish potting our plant without reference to this. If the soil is too dry, good potting is thereby rendered impossible. If too wet, the results on the process of potting are even more disastrous. A good practical test is to take a handful of the compost firmly in the hand, and squeeze it tightly together. If it so slightly adheres under the pressure as to crumble into fragments so soon as the hand is suddenly opened, it is neither too wet nor too dry.

The mechanical state of division of the compost is also a matter of much practical importance. At one time, and for all purposes, all soils were run through a sieve before being used for potting. Now sifted soils, unless for the sowing of seeds, and the pricking off of cuttings or seedlings, are almost banished from our gardens. The roughness or fineness of the compost should, however, be largely determined by the size of the shift. It would be hopeless to attempt to force lumps of peat or loam two inches square into inch areas between the roots of plants and the sides of the pot. The larger the shift, the coarser the soil, and *vice versâ*.

As to solidity of the new earth, that should be largely influenced by the character of the soil, and the hardness of the old ball, and can hardly be properly determined without a reference to the balls of plants. These are the mass of roots, soil, and crocks that fill the pots. The latter, or drainage, however, is seldom included, unless, as is very frequently the case, it has also been laid hold by the roots so firmly as to have become inseparable from the soil. These balls prove at once a help and a hindrance to many potters. They enable the roots of plants to be inverted and examined in the mass without difficulty. But they also not unfrequently imprison the roots in such iron-like fetters as to render their liberation and enlargement utterly impossible. Sometimes they become so saturated that it is impossible to dry them; at others, so dry that it takes days of thorough soaking to wet them through. Plants seldom recover from the first condition, and no plant should be shifted into a larger pot with a sour or saturated ball. Leave it without water till it dries, if it ever does so. Dry balls should be steeped until wet through, and then stood out in an empty pot somewhat larger than the ball to drip dry before being shifted into larger pots. When extremely hard, as in the case of many Heaths, and plants of similar character, it is useless to try and soften or disturb the ball. With care, some of the surface roots may be slightly disturbed. In the process of potting aim at making the added soil as hard as the substance of the ball; it is impossible by any amount of ramming with fingers and thumbs, or the use of potting-sticks, to do this. But it should be aimed at

nevertheless, and the nearer this ideal excellence is attained to, the sooner will the roots strike from the ball into the fresh soil. Hence, the state of the old ball must, as far as possible, be the measure of the degree of solidity of the new compost. The harder the roots and wood of plants, the harder in general should the soil be made in the pots.

A free use of porous materials should, however, be always combined with this solid mode of potting. Hence the great use of small lumps of charcoal, sandstone, flints, crocks, cocoa-nut and vegetable fibre in composts; these all form or keep open water-ways towards the drainage in the base of the pots.

Temperature.—In potting, the temperature of the soil and of the potting-shed should also be carefully considered.

Plants, like ourselves, suffer more from chills than from most other causes. If this extends to their roots as well as tops, and they are brought out of a temperature of 70°, and placed in soil at 40°, they must needs suffer severely in consequence. Hundreds of fine plants have thus met with disease and death on their way to and from the potting-bench and their treatment when there. Cold pots alone have chilled many a plant into sickness. Let every potter then see to it, that all his materials are of a higher rather than a lower temperature than that in which the plants have grown.

After-treatment.—In general terms this should consist in a little extra fostering of growth. There may be a slight rise of temperature. There should be a more genial atmosphere, and in all cases of small shifting, there should be moderate watering, with water a little warmer, say 5° or even 10° warmer, than that to which the plant has been accustomed. This will serve the double purpose of heating the soil, and also of affording a mild stimulant to the newly-displayed roots. Nothing benefits tropical plants so much, nor starts their roots anew so soon, as a bottom heat of 80° or 90°. They respond to this at once, and the roots plunge into and occupy the new soil before those that have no extra stimulus have made a start. An overhead syringing two or three times a day, and partial shade for a few hours on either side of noon, also prove useful for a week or so after shifting. A great deal, however, depends on the time when plants are potted, and the amount of root-disturbance. In regard to the more common practice of shifting common plants into larger pots as they require, the roots are hardly checked or disturbed at all, and no unusually fostering treatment is needed afterwards.

The One-shift System.—Some thirty years ago this system threatened to abolish all successional pottings. The plants took but one step from their first pot into their last. Virtually, it may be said to have substituted planting out for pot-culture; since a plant suddenly moved out of a pint or less of soil into half a bushel or more might just as well have been placed in the open border; for of course it was weeks, it might be years, before the roots reached the sides of their larger quarters, and thus discovered that they were in pots. The successes obtained by this system were marvellous. Many hard-wooded plants of most difficult cultivation made what has been called mushroom growth, and these have proved as lasting as their production was rapid. Under this system, the roots from the first and all through have free course, and are tempted by good porous soil to ramify freely in all directions.

The success of the one-shift system may be said to rest upon a three-fold basis—thorough drainage, rough and porous soil, and careful watering. Of course, in transferring a small plant from a three-inch pot to a twelve or a sixteen-inch, liberal drainage, that is, a layer of hard solid crock, or charcoal, from four to six inches in depth, would not be excessive. Not only this—the whole compost should be so compounded and constructed as to become a secondary drain. All this can be done easily, without the complicating presence of roots and the difficulties of limited areas. Beginning with the drainage, the entire compost may be placed in and intermixed with crushed shells, charcoal, flints, or other hard porous materials as the process proceeds. The compost may be composed of large pieces near the bottom and sides, gradually becoming smaller towards the top. A very small space in the middle of the pot suffices to receive the plant, which crowns, rather than occupies, the pot that it is expected by-and-by to fill and partially hide with its beauty. The soil should be used dry and packed in firmly, as there is considerable danger of its subsiding so as to sink the collar of the plant too far below the rim of the pot.

In watering plants potted on this system, great care must be taken not to wet the unoccupied soil, as otherwise its goodness would be washed out and its porous texture ruined long before the roots reached it in force, and so helped to preserve its texture, its richness, and sweetness. Only as far as the roots extend, must be the rule in watering, as the mass of soil around, as well as beneath them, will conserve the moisture given; but very little water will be needed for the first few months of the one-shift system. This fact very much weakens the force of the objection so often taken against it—viz., that the soil has all its virtues washed out before the roots can reach it. The whole system is a water-saving expedient from first to last.

The best season to pot plants on this system is in the early spring, with all the growing months and the whole of the ripening season ahead of the cultivator. The fostering genial influences already referred to as useful after potting, may all be augmented on the one-shift principle. Not an hour should be lost in fostering, forcing if need be, the action of the roots. If they stand still long, the plants may be said to be already lost. But, starting promptly, they grow with astonishing vigour; and more growth is often made in one year on the one-shift system than in six under progressive potting. It takes a good deal of room and involves considerable risk, but these drawbacks are amply compensated for by success.

Modifications of the system have also affected all other methods of potting, inasmuch as the shifts are now much larger and the composts rougher than they used to be.

The one-shift system also answers admirably for most soft-wooded plants, and such showy annuals as Cockscombs, Balsams, &c. For these the richest soils may be used, a full half being manure, and these yet further enriched with crushed bones, malt-dust, guano, and other stimulants. Exposed to full sunlight and stimulated by a bottom heat of 80° or 90°, one may almost see such plants grow, and Balsams may be grown into dwarf trees, and Cockscombs as large as cockerels, under such forcing conditions.

Nevertheless the one-shift system has gone out of fashion, and progressive potting, modified and improved by its influence, as set forth in these pages, is now the order of the day in almost all horticultural circles.

FLORISTS' FLOWERS

By Richard Dean.

Balsams.—Time was when the Balsam was a much more popular flower than it is in the present day, for then it was regarded as a florist's flower; was greatly improved by careful selection; and the flowers gradually became much more double, and decidedly more symmetrical in shape; it was also largely seen at horticultural shows. Then for a time, owing probably to the bedding-out system having gained such an ascendency over the minds of gardeners, the Balsam and other kindred subjects fell into neglect. There are, however, indications that this handsome flower is again rising in popular favour: and the systems of culture now adopted are much simpler than they were years ago. Then, "disbudding, stopping, and other interferences with the natural growth of the plant were resorted to, to produce fine specimens and double flowers. But there is only one mode of cultivation worthy of attention, and that is the natural way; and it can be made to produce fine and handsome specimens. The old rules of pinching back the leader to promote the growth of side shoots, and removing the flower-buds in order to increase the size of the plants, were vicious observances, because the natural growth is more elegant and effective, and the finest flowers are produced on the main stem, and, therefore, are completely sacrificed by disbudding."

Balsams can be easily raised from seed, and it is necessary, in order that the flowers shall be satisfactory to the cultivator, that it be of a good strain. It is not necessary to sow the seed in heat, for it can be raised in an ordinary green-house by sowing the seeds thinly in pots or pans of light soil, or on an open bed that gardeners sometimes find it convenient to make up in a green-house; and germination is hastened by placing a piece of glass over the surface of the pots. Indeed, the seed would grow in an ordinary frame if sown in March or early in April. As soon as the seedlings are large enough to transplant, they should be potted singly into small pots, and if possible placed in a little warmth to quicken their growth. The Balsam is a quick-growing succulent plant, and at all stages of its growth rich soil should be employed. Some good yellow loam, plenty of leaf-mould, rotten manure, and silver sand, well mixed together, make an excellent compost. What the cultivator should aim to do is to encourage a dwarf, stout, and vigorous habit of growth; and it is a great mistake to leave the plants too long in the seed-bed, where they become spindly and weak. As soon as the pots are pretty well filled with roots, another shift should be given; and when shifted, the plants should be placed as deep in the pots as possible. After a shift, they should be kept close for two or three days, and then fully exposed to light and air. From all points where the stem comes into contact with the soil fresh roots are thrown out, and these assist to increase the development of the plant; therefore the advantage of placing the plants as deep as possible in the soil is made clearly apparent.

The importance of frequent shiftings in the early stages of growth cannot be over-estimated. It is in this way that the foundations of fine specimens are laid. Any check through being pot-bound, or becoming too dry at the roots, has an injurious effect on the plants, and should be carefully guarded against. A free growth must be encouraged in every possible way. Pots from eight to ten inches in diameter will be large enough for the final shift, and in these we have seen specimens grown of wonderful size, and carrying remarkable heads of flower. It is when the roots touch the sides of the pots, and

CART.R'S CHALLENGER PRIZE BALSAM.

crowd the soil, that the plants show flower-buds, and expand into full symmetrical blossom. But it is of the utmost importance that at this stage the plants be on no account allowed to become dry, nor be overcrowded, and that they have plenty of air. The more sturdy and vigorous the growth, the more satisfactory will be the head of bloom.

The Balsam makes an excellent out-door plant, if planted in proper soil. It must be rich, and if it is intended to make a bed or a plantation of Balsams, the soil should be deeply dug and well manured. An open sunny position is necessary: and if the plants have been grown on in pots, they can be planted out early in June, if the weather is at all favourable. In warm, moist, bright weather, Balsams make a very free growth in the open air; and if carefully watered in dry weather, they grow into plants of large size and fine proportions, and make an excellent return for the labour bestowed upon them.

And it is surprising how long a time a Balsam plant will flower in the open air, when it is in good soil and moist at the roots. It throws out a number of lateral or side shoots, and these become filled with flowers, and so the floral succession is carried on. Perhaps Balsams are seen to the best advantage in the open border when they are planted singly among other plants; but we have seen them very effective in a large bed by themselves, with some plants of the Dwarf or Tom Thumb section planted as an edging. It is a good plan to plant tall Asters and Gladiolus among them, as it tends to relieve the formal character or outline of the Balsams; and the added plants, being later in flowering, furnish blossom when the Balsams are fading. It must not be forgotten that the Balsam is a tender annual, and very susceptible of frost, and it should not be planted out in the open ground until the spring frosts have ceased.

There is one good strain of Balsams, viz., the Double Camellia-flowered, and this comprises several varieties, such as the scarlet, purple, rose, cream, white, &c., as well as pretty flaked and blotched varieties. It is also known as the Rose-flowered. The self-colours are generally the most double, and a few of these are somewhat extensively grown for Covent Garden Market.

It is surprising what large and finely-flowered specimens of Balsam one sees in the London plant markets growing in quite small pots. They are grown on rapidly in a strong heat, well cared for, and abundantly watered with weak liquid manure. But it is only market growers that can produce such specimens in such small pots, and in such an incredibly short space of time. As to the course of treatment pursued to obtain such results, the market grower selects a few varieties remarkable for fine double flowers. The seeds are then sown in a strong bottom heat, in spring; and as soon as they are large enough to be handled, they are placed, singly, in small pots, grown on vigorously, and shifted into pots of a larger size, until they occupy 48-size, or pots four and a half inches in diameter. The plants are grown in low span-roofed houses, and kept near the glass, where they have plenty of light; and when the pots are filled with roots, and they are showing for bloom, they are watered two or three times a day, according to the weather; and at least once a day with weak liquid manure. Let any one purchase a market Balsam, and turn it out of the pot, and he will find a perfect hard ball of roots. But it is the constant watering, and the warm, moist heat in which the plants are grown, that keep them such perfect specimens, and make them the wonder and admiration of all who see the plants in the London markets.

Begonias (Tuberous-rooted).—Probably no group of plants is so popular in the present day as the tuberous-rooted Begonias, and they may be said to have taken the place of the Zonal Pelargonium in public estimation. And it is not to be wondered at, for they are perennial in character, easily grown, very free and continuous in bloom. Seeing that new varieties can be raised from seed with comparative ease, thousands of seedlings are annually produced; and so generally fine are they that in a short time the naming of particular varieties will cease, except in the cases of those of exceptional and striking character.

Let us shortly trace as accurately as possible the introduction and development of the tuberous-rooted Begonia. It is nearly twenty years ago since Messrs. Veitch and Sons' collectors sent home to them *Begonia Boliviensis*, *B. species*, and *B. Veitchii*, all flowering tuberous-rooted varieties, which created quite a *furore* when they were first exhibited. Shortly afterwards, *B. Pearcei*, a very distinct yellow-flowered type, was also sent home to Chelsea. These proved of the greatest value for hybridising purposes, and in the hands of a clever manipulator at the Chelsea nurseries, there was produced in 1868, *B. Sedeni;* in 1870, *B. intermeaia;* and several others followed in rapid succession. The first English hybrid was *B. Sedeni*, with pale scarlet flowers, sold first in 1870; then followed *B. intermedia*, in 1871; *B. Chelsoni*, in 1872; *B. stella*, and *B. Vesuvius*, in 1874, &c., all produced by Messrs. Veitch and Sons; and it is to this enterprising firm that we owe the commencement of the work which resulted in the splendid development seen in the present day. Subsequently other persons interested in the Begonia

took up the work of improvement so auspiciously commenced, and carried it on with success. One of these was Mr. O'Brien, then of the Wellington Road Nurseries, St. John's Wood. Prominent as a raiser is Mr. John Laing, of Stanstead Park Nursery, Forest Hill, who has made a great speciality of this plant, has greatly improved it, and who annually raises thousands of seedlings. On the Continent also Mons. Victor Lemoine and others had been at work; and the best of their productions, as well as of those that had emanated from Chelsea, were used by Mr. Laing and others for crossing purposes. The latter made use of everything good that he could lay his hands upon, and with excellent results. Here it may be remarked that the earliest introduction, *B. Boliviensis*, had long-pointed petals; but *B. Veitchii*, also introduced, had petals of a broader and rounder character. A union of these two gave *more* rounded and broader petals than the last-named parent, thus giving a very interesting example of the curious effects of hybridising in modifying the forms of flowers. In the present day, massive petals or segments have so broadened that they overlap each other; and the leading flowers are of great size and splendid quality. The predominating colours are pink, rose, scarlet, and crimson; but *B. Pearcei* and other hybrids of a similar colour have produced flowers of rich shades of lemon, yellow, and orange; while pure white, creamy, blush, and flesh-coloured varieties, of rapidly increasing quality, are getting quite numerous.

Up to a certain period the varieties of tuberous-rooted Begonias were all single-flowered. Then varieties bearing double flowers came to this country from across the Channel. Mons. Victor Lemoine, of Nancy, was one of the first to exhibit these. There had been produced in England some semi-double types, but they fell short of the fully double character of the varieties raised in France. Mons. Bouchet, a gardener near Paris, was successful in raising some double flowers of the *Boliviensis* type. The fine full varieties introduced by M. Victor Lemoine were taken in hand by Mr. Laing, and he is now quite in the foreground as a producer of these. Some of his more recent doubles are characterised by great size and wonderful fulness, looking more like hollyhock flowers. Occasionally new varieties of this character come to us from the Continent, and a few other English raisers are doing their share also. But it is Mr. Laing that has taken the lead: and for eight or nine months in the year, at least, he has a large and unrivalled collection in flower.

Begonias can be raised from seed with the greatest ease provided a little bottom heat be at command: at the same time seedlings can also be raised in an ordinary unheated green-house, placing the pans or pots on a warm shelf near the glass, and covering with a piece of glass to induce a more rapid germination; and shading from the sun when necessary. But a much better start can be effected when the seed is raised on a gentle bottom heat. The seed should be sown as thinly as possible in well-drained pans or pots, using a mixture of leaf-mould and silver sand, carefully sifted, to take from it any lumps or stones. This gives what is absolutely necessary—a light, free soil—and it should be used moist, but not wet or sticky. The surface should be made flat and smooth, and the seeds sprinkled upon it as thinly as possible, and at the same time equally; and then covered with a very slight sprinkling of dry silver sand, this being necessary to fix the seeds, otherwise in moving the pans the seeds might run together. The pans should be placed in a warm house, and in a moderate bottom heat; placing a sheet of glass over each pan to promote germination and prevent evaporation. The seeds must on no account be allowed to become dry, but when it is necessary to give water it must be applied with the greatest care. The best plan is to dip the pans in a pail of lukewarm water, but not sufficiently deep to cover the surface; the water will gradually rise and moisten this. As soon as the seedlings are large enough to handle, the largest of them, if not all, should be pricked off into other pans or pots of similar soil, but this is an operation requiring great care. At the Stanstead Park Nurseries, where thousands of seedlings are raised, two persons sit, one on either side of a pan, which is raised breast-high. Each has a piece of thin stick, a foot in length, pointed at one end, and with a cleft at the other end. The pointed end is placed under the tiny plants, and they are gently raised by it, but not lifted entirely out of the soil. The pointed stick is then employed to make a hole in the pan to be filled; then by reversing it and using the cleft end, which grasps the tiny plant under the seed-leaves, it lifts it, places it in the hole made for it, and the pointed end is again used to press the soil about the roots. A little fine silver sand can be dusted over the surface, the pans are returned to the warm house, and their occupants soon lay hold upon the soil with their roots. Pricking off in this way may be done with advantage two or three times, giving the plants more room each time, and encouraging them to grow as strongly as possible. When but a few seedlings are grown, they can be potted off singly to flower. Mr. Laing plants out in prepared ground in the open air every year thousands of seedlings, and a large number of them flower the same season.

The tuberous-rooted Begonia being a perennial, the tubers must be wintered after the foliage has died down. When the foliage commences to decay,

water is gradually withheld, and the soil allowed to become dry, but not entirely so. Then the tubers should be shaken from the soil at the proper time; and, after being dried, should be placed when not in any special way pushed into activity, but left to start of their own accord. If they have been wintered in pots and begin to show signs of growth, shake all the old soil from the roots and

Single-flowered Begonia, Black Douglas.

in boxes, in dry sawdust, and packed away, keeping them during the winter in a dry cool place. When only a few tubers are grown they can be wintered in the pots of soil, but not kept quite dry; or the roots can be shaken from the soil and put singly into pots of sawdust, and wintered where they will be unharmed by frost.

As regards starting the tubers into growth, it may be stated that they make the finest growth and bloom re-pot into small pots, the less soil the better until they come into growth. Give good drainage, and use a light sandy soil. Some care is required at first starting, or the tubers are apt to decay. They should have warmth until fine weather arrives, and then plenty of air. Then the plants must be shifted into larger pots as necessary, if it is the desire of the cultivator to have fine and handsome specimens.

Most amateur cultivators of the Begonia who raise

seedlings will find it expedient to plant them out in the open ground, say, early in June if large enough. It is true the plants will flower late, and some may not bloom at all; but it will enable the cultivator to ascertain the varieties worthy of being retained of those that bloom, and he can reject all inferior forms. Now, if some of the best of these flowering planted-out specimens be taken up from the open ground during September, carefully potted, and put into a green-house, they will continue in bloom for a considerable time, and will be of use for decoration at that season of the year. Begonias are hardier than is generally supposed; they need no protection, and require no heat, except in the seedling stage, when first forming their tubers.

But supposing a raiser of seedlings should be fortunate enough to raise one or two fine varieties, how can he increase them? as he may desire to grow nothing else. He can do this by means of cuttings, and the best course will be to start the tubers into growth early in March in a rather brisk temperature, and to commence taking the cuttings as soon as the growth is sufficiently advanced, and continue the work as successive crops of lateral shoots are produced. The plants must not be cut back too severely in order to obtain cuttings, or the growth made afterwards will be more or less weak, and be decidedly unsatisfactory. The cuttings as they are obtained should be inserted, either singly or two or three together, in small pots, and placed in a propagating frame or in a heated pit where they can have the assistance of a little bottom heat, and be shaded from brilliant sunshine. Cuttings of Begonias do not require to be kept so close and moist as those of most other subjects, and it may also be observed that the cuttings taken during the summer months can be struck most readily without the aid of bottom heat. The cuttings should be put singly into three-inch pots as soon as rooted, and those struck early in the spring may be planted out at bedding-out time; but those struck at the end of the spring season and during the summer months should remain in the pots until early in the year following. The latter should have a place in a light airy pit, with moderate supplies of water until September, when the water must be gradually withheld; and, as the stems die down, they may be stowed away for the winter under the green-house stage, or remain in the pit with protection from frost.

At most of the flower shows, prizes are offered for tuberous-rooted Begonias in flower. The best plants to grow on for exhibition are two-year-old seedlings; and supposing the specimens are required for the show at the end of July or during August, the tubers should be potted in April, selecting pots that will allow of an inch space or so between the edge of the tubers and the pots. They should be clean and well drained; and the compost employed should be one made up of sandy loam, plenty of leaf-mould, and well-rotted manure. They should be potted so that the crown of the tuber is level with the surface, and the soil should be pretty firmly pressed about it. The pots should be placed in a warm house, but where they can have plenty of light; and when the plants have pretty well filled the pots with roots they should have a slight further shift, and this must be repeated as long as necessary. As the plants grow on into size they must have plenty of light and air; for if they become drawn they will be practically useless for exhibition purposes. There should be no difficulty in having, in the space of four months, plants two feet or even more in diameter.

There is one very useful decorative purpose to which Begonias can be put—as basket-plants for the decoration of the green-house and conservatory. The single and double varieties are both used for this purpose. The tubers should be started into growth in pots, and when they have made shoots some three inches in length they should be transferred to the baskets in which they are to flower. Wire baskets, about a foot or fifteen inches in diameter, are the best. Three plants should be put into each basket, and the spaces between them carefully filled with soil similar to that in which the tubers were first potted. When this is done the plants need just sufficient warmth to insure a fine growth, and they should be kept near the glass, using a thin shading to the house in bright weather. The baskets should be about eighteen inches from the glass; and as the plants make a vigorous growth the shoots will depend naturally over the sides of the baskets, and when they are full of bloom they have an extremely rich and elegant appearance. They are also very continuous in blooming. We have seen, in Mr. Laing's nursery, baskets so filled of prodigious dimensions, and objects of great beauty during the summer season.

There is a group of flowering Begonias of a very interesting character, easily grown, and very free of bloom, mainly in winter and spring. These, however, requiring heat, come more properly under the head of Stove Plants, and will be treated under that section. They are indigenous to both the Eastern and Western Hemispheres, the greater portion having been introduced from South America, and large numbers of fine hybrids have been raised in gardens. By the use of a few varieties they can be had in bloom all the year round; but it is in the winter and early spring that they are most useful. Some of these varieties are used with excellent effect in the flower garden during summer.

Selections.—The following is a list of some of the best varieties in cultivation:—

SINGLE-FLOWERED BEGONIAS.

Favourite (Cannell).
Indian Chief.
Orange Perfection.
Crimson King.
Glow-worm.
W. E. Gladstone.
Rosy Morn.
Earl of Bessborough.
Countess of Bessborough.
Lady Kirk.
Mdlle. Tressoneau.
Mr. Laing.
Garnet.
Shirley Hibberd.
Countess of Kingston.
Crimson Perfection.
Mrs. H. Cannell.
Wonder.
L'Abbé Froment.
Rêve d'Or.
Salmon Queen.
Jeanne d'Arc.
Alba florabunda.
Monarch.

DOUBLE-FLOWERED BEGONIAS.

Intermedia plena.
Leon de St. Jean.
Esther.
François Brechnir.
Le Grand Citoyen.
Blanche Duval.
Lucie Lemoine.
Grandville.
Comtesse H. de Choiseul.
Madame Comesse.
William Bealby.
Mons. Legouve.
Gabrielle Legros.
Louis d'Or.
Marie Lemoine.
M. Paul de Vicq.
Rosamonde.
Gloire de Nancy.
Sir Bealby.
Mons. Bauer.

Carnations and Picotees.—The Carnation and Picotee are varieties of *Dianthus Caryophyllus*, though some have asserted that the Picotee is a distinct species. These flowers, as well as the Pink, are said to have been introduced first into England from Italy, and have derived their names in the English language from their colour—Pink, Carnation or flesh-colour. The Carnation was also, as well as the Clove, styled by the old English florists, *Clove-Gilliflower*, from its blooming in July. Carnations are divided into two main divisions, Bizarres and Flakes. There are three classes of Bizarres—Scarlet, Crimson, and Pink and Purple; and there are Scarlet, Purple, and Rose Flakes. Bizarre is an epithet borrowed from the French, implying something fantastic, and there must be three distinct tints or shades. Flaked flowers have stripes or flakes of colour on a white ground.

CARNATION.

In order to make the distinctions of the florist as clear as possible, we refer to the accompanying diagram. In all cases of what are termed the "show" varieties of Carnations and Picotees the ground-colour of the petals is white. This is flaked and barred with colour; and in a show Carnation the flakes all run radially, from the centre of the flower to the edges of the petals. In order to have a "Bizarre" Carnation, then, there must be at least two distinct colours marked on the white ground, as seen in the accompanying diagram. A "flaked" Carnation has a white ground also, with clearly defined flakes of colour also running radially along the petals, and reaching to their edges. In the case of a Scarlet-flaked Carnation, the colour is scarlet; a Purple-flaked, purple; and a Rose-flaked, rose, on the white ground; and in some varieties of Scarlet-flakes, for instance, the colour is denser than in others.

Picotees are unlike Carnations in that the colours are confined to the margins in the form of an edge, and there are Purple-edged flowers, Red-edged, and Rose-edged; and these are again divided into Heavy and Light edges. Picotees have white grounds to the flowers also, but instead of the snowy petals being flaked or barred with colour, it is entirely on their edges, narrow in what are termed Light-edged flowers, broad in Heavy-edged flowers. The Picotee is generally less robust in growth than the Carnation, but it must not be supposed that it is therefore necessarily of delicate constitution. There is a class of yellow-ground Picotees, of delicate growth, requiring great care in cultivating them; but of late years a much stronger-growing race has been introduced, which are becoming great favourites because of their more easy culture.

PICOTEE.

Cloves are generally self-coloured flowers—Carnations or Picotees in which one or more colours are distributed all over the flower.

A new race is termed *Fancy Carnations;* they have coloured grounds to the flowers, such as pink, rose, mauve, pale scarlet, &c., with flakes of some deeper colour, differing from the older "Show" Carnation in the tinted ground. They are becoming great favourites.

The fine named varieties of the Carnation and Picotee are generally grown in pots. On the whole they are of a robust constitution, and do well in the open ground, but the finely-marked flowers that the florist prizes so highly can only be had on plants cultivated in pots, and so under control. Any one cultivating a few varieties of each for pleasure will find it to their advantage to grow them in pots.

Culture.—Any one intending to cultivate these plants should obtain their plants in the autumn, in the form of nicely-rooted layers. These should be potted singly in small pots, or two plants in a large pot, one on either side. And now comes in the matter of compost, which is one of great importance. That most recommended by growers is one made as follows:—good and rather adhesive loam, four parts, one part rotten stable manure, and one of leaf-mould, with enough of coarse sand to keep it open; and of late years cultivators have added a little broken

charcoal. This is a good soil for use in all stages of the plant's growth.

During the winter the plants in pots should be kept in a cold frame on an ash bottom, and carefully looked after, and air given on all suitable occasions. Potting into the blooming pots is done about the middle or end of February. The Carnation and Picotee are potted into large pots for flowering. A single plant is put into a pot seven inches in diameter; two in a nine-inch; and three in a ten-inch pot, the latter being the most generally followed method. The pots must be well drained, and broken oyster-shell is the best drainage that can be used, and some coarse siftings of the soil should be placed over the drainage before any soil is put in. The pots should then be filled within two inches of the top, the plant or plants should be placed in position, and the soil pressed about them, making it fairly firm; then by gently knocking the bottom of the pot on the ground the whole settles down, and the work of potting is complete. This done, the pots need to be placed in a cold frame and kept a little close until they become established, and then placed in the open air, standing them on pots or slates to prevent worms passing up into them. The plants need close attention in the matter of watering and keeping them clear of insects.

As the flower-stems are thrown up they should be securely but not too tightly fastened to stakes. The stoutest osiers used by basket-makers make excellent stakes for the purpose; and they can be had made of deal and painted green, and they should not be less than three feet long. In order to have fine full flowers it is necessary to thin out the buds. Not a few Carnations and Picotees have a tendency to burst the calyx, *i.e.*, the green sheath which encloses the bud, and it is a common practice to bind a piece of bast round it, taking care not to tie it too tightly so as to prevent the flower from expanding. Those who grow flowers for exhibition purposes are obliged to shade them, and this is done by means of zinc shades fastened to the sticks, by a canvas covering, or by taking the plants into a house. When shaded, the blooms remain in perfection for many days.

During the time that the plants are getting into flower, all weeds and dead leaves should be removed, and the surface soil stirred, and top-dressed once or twice, with a compost made up of half loam and half leaf-mould. This is a matter of great importance in insuring a healthy development of the plants. Earwigs prove very destructive to the flowers, and they should be looked for and destroyed. If the plants are grown solely for decorative purposes, disbudding need be done only very sparingly.

Propagation.—This is done by layering, a process of importance, and requiring skill and experience to do it effectually. The more the plants are exposed to the sun previous to layering, the more robust and hardened is the wood, which is a matter of great importance. And as some sorts are shy in producing roots—a knowledge to be gained only by experience—these should be layered first of all, to give a greater duration of time to root properly. First of all the operator should make up a compost composed of equal parts of sweet turfy loam, leaf-mould, and sand passed through a fine sieve. Then all the leaves up to the third joint from the tip should be cut away with a pair of scissors, and the spent soil removed from the pot to the depth of three inches, and some of the fresh soil placed in the pots. Then by means of a sharp pen-knife an even slit is made from one joint to the other, taking care not to cut right through the wood. This tongue so formed eventually puts forth roots. It must be inserted in the fresh soil, placing a peg (those made from the common fern of the woods are best) to keep it secure in the soil, and after the whole of the layers are operated on and made secure, they must be slightly covered with fresh soil, and then watered through a rose watering-pot. The plants can then be placed in the open air, well attended to in the matter of watering, and in a month or six weeks the layers will be rooted, and eventually these can be potted off as recommended at the outset of this article. One of the best layerers of Carnations and Picotees we ever knew, used to insert his knife in the stem, and then cut outwards, doing this with great certainty and dexterity, and so forming a tongue. But it requires great practice and care to layer rapidly and safely.

Fine new varieties of Carnations and Picotees are also obtained from seed, which, if sown at any time in pots or pans of light sandy soil and placed in a cold frame, soon germinates, and the young plants can then be pricked off when large enough to handle into other pots, and grown on as required, and finally planted out in spring in a well-prepared bed to flower. Such a bed should be raised above the level of the ground, so that there should be a fall for the water in the case of heavy rains.

Selections.—The following selection of Carnations and Picotees includes the best varieties:—

CARNATIONS.

Scarlet Bizarres.	*Crimson Bizarres.*
Admiral Curzon.	J. D. Hextall.
Arthur Medhurst.	Master Fred.
Robert Lord.	E. S. Dodwell.
George.	John Harland.
Fred.	Rifleman.
Edward Adams	Harrison Weir.

SELECTION OF CARNATIONS (*continued*).

Pink and Purple Bizarres.
H. K. Mayor.
Squire Llewelyn.
Thomas Austiss.
Sarah Payne.
Unexpected.
William Skirving.

Scarlet Flakes
Clipper.
Henry Cannell.
John Ball.
Sportsman.
Tom Lord.
James Cheetham.

Purple Flakes.
Dr. Foster.
George Melville.
James Douglas.
Florence Nightingale.
Martin Rowan.
Mayor of Nottingham.

Rose Flakes.
Crista-Galli.
James Merryweather.
Jessica.
John Keet.
Miss Erskine Wemyss.
Sybil.

PICOTEE, MRS. CHANCELLOR.

CARNATION, DAN GODFREY.

SELECTION OF PICOTEES.

Heavy Purple-edged.
Mrs. A. Chancellor.
Zerluia.
Muriel.
Mrs. Niven.
Mrs. Summers.
Alliance.

Heavy Red-edged.
Brunette.
J. B Bryant.
John Smith.
Dr Epps.
Mrs. Dodwell.
Dr. Abercrombie.

Light Purple-edged.
Clara Penson.
Her Majesty.
Mary.
Ann Lord.
Minnie.
Mrs. Niven.

Light Red-edged.
Mrs. Bower.
Mrs. Gorton.
Rev. F. D Horner.
Thomas William.
William Summers.
Violet D uglas.

SELECTION OF PICOTEES (*continued*).

Heavy Rose-edged.
Constance Heron.
Ether Minnie.
Fanny Helen.
Mrs. Sharp.
Edith D'Ombrain.
Mrs. Payne.

Light Rose-edged.
Daisy.
Favourite.
Miss Gorton.
Nellie.
Purity.
Mrs. Nicholl.

Carnations and Picotees (TREE OR PERPETUAL).—This is a most useful section of Carnations, flowering in autumn and winter under glass, and of great value for cutting from at these seasons. It is a flower

that has been greatly improved by Mr. C. Turner, Royal Nursery, Slough, who has a very extensive collection. They require a different treatment to the ordinary Carnations, and they are of a true perennial character. The plants are generally grown singly, in five-inch or seven-inch pots, under glass, in a cool

A. Allegatière. Laura.

Tree Carnations.

green-house, where plenty of air can be admitted; and when the plants are in a forward state, and showing freely for bloom, a little gentle warmth is required to assist in the expansion of the flowers. At the same time, plenty of air should be given in the day-time on all suitable occasions, so as to dry up any damp that may be in the house; especially so, as in the autumn and at mid-winter damp will cause the flowers to decay in the bud. The soil requires to be kept moderately moist. The plants must not be allowed to become dry at the roots, and they require to be kept clean in every way, and especially clear of green-fly. If it is not convenient to fumigate with tobacco-smoke, the insects can be brushed away with a camel-hair brush. So treated, strong plants will flower through the winter months, and be a great source of pleasure to the cultivator.

In the case of Tree Carnations and Picotees, the definitions which divide the "Show" varieties, as they are termed, into Bizarres and Flakes, and these again into their sub-divisions, are lost, or—shall we say? —cannot be observed. A few are white-ground flowers, many are coloured, and the colours run so much one into the other, and they are in not a few

instances so curiously blended, that anything like classification is out of the question. Moreover, some flowers partake both of the character of Carnation and Picotee, which adds to the difficulty of dividing them into anything like intelligible sections. Besides, while in the case of the florists' Carnation and Picotee the petals are considered to be most perfect when they are smooth or rounded on the edges, the petals of Tree Carnations are both smooth and fimbriated, as can be seen in the accompanying illustration, and some of the most striking flowers are those having petals with fringed edges. Not a few are marked in an eccentric and grotesque manner. Some of this mixed character may be due to crossing; but this class of Carnations seems to have a natural tendency to "sport" without any special attempt on the part of the florist.

Time was when the few perpetual Carnations to be met with in this country were of a tall lanky growth, and having somewhat poor flowers. The introduction of some Continental varieties of strong, free growth, proved of great service to English florists, who set to work to take seed from these and raise new varieties; and from these have sprung a race dwarfed in growth, more vigorous in habit, and earlier to bloom, as well as producing flowers much more freely.

In propagating these winter-flowering varieties, they are not layered, but increased by "pipings," or cuttings, in the same way as Pinks. The best time to do this is at the end of February or early in March, placing them in pots of soil composed in great part of sand, putting eight or ten pipings into a four-inch pot, and pressing the soil firmly about them, giving them a good sprinkling overhead, and placing the pots in a gentle bottom heat. In about three weeks these pipings will be sufficiently rooted to be potted off singly into three-inch pots, and when well established, hardened off gradually, and then shifted into larger pots, according to the strength of the plants. When established, the plants should be placed out of doors on a floor of coal-ashes during the summer months, kept well watered, and as they make growth be properly staked, and carefully tied to the stakes to prevent any damage from winds. There is a small group of yellow-flowered Picotees which can be treated in much the same way, and are also found very useful for cutting from, as well as of great decorative value.

A useful selection of Tree Carnations will be found in the following:—

A. Allegatière.
Bright Phœbus.
Brunnette.
Cardinal.
Cassandra.
Enchantress.
Gaiety.
George Rudd.
Juliette.
La Belle.
Lady Lonsdale.
Laura.
Miss Joliffe.
Mrs. Dix.
Mrs. Llewelyn.
Souvenir de la Malmaison.
The Queen.
Worthington Smith.

Cloves.—Clove Carnations now form a numerous group, and they have been greatly increased of late by the addition of a large number of fine varieties. Whether the original form of *Dianthus Caryophyllus* was white on the ground or coloured we cannot state, but it may perhaps be presumed it was flesh-coloured. Cloves cannot be obtained with certainty from seeds; and a large number of the varieties are self-coloured forms of the Carnation. Sometimes a plant, of say a scarlet Bizarre Carnation, will produce flowers wholly scarlet, and then it is to all intents and purposes a Clove. A florist terms these "run" flowers, and the plants are rejected by him because they cannot be depended upon to produce anything but self-coloured flowers in the future. This is one of many illustrations of the singular way in which flowers sport; but the causes operating to this end are as yet among the secrets Nature keeps hidden from the children of men. All the Cloves, like some of the stronger-growing Bizarre and Flaked Carnations, do well in the open air, and make excellent border flowers. While many of them are deserving of pot culture, they are more generally cultivated as border plants. They should be planted in a rich, deep, sandy loam—a soil that suits all the Carnations and Picotees—and are increased by layers.

There is also a group of Fancy Carnations which are flaked, edged, and striped on dark grounds; they come between what are known as the Show, and Clove or deep-coloured varieties, and for the sake of convenience have been denominated "Fancies."

The following will be a good selection:—

Clove Carnations.

Anna Williams, deep pink.
Bride, white.
Chieftain, bright crimson.
Coroner, bright scarlet.
Dominie Sampson, ruby.
Elegant, reddish-purple.
Euphrosyne, rose.
Gloire de Nancy, pure white.
Hindoo, dark crimson.
Lord Rosebery, deep rose.
Mary Morris, pure white.
Miss Wheeler, sulphur and white.
Mrs. Whitmore, bright rose.
Neptune, purple.
Pride of Penshurst, bright yellow self.
Purple Gem, bright purple.
Sultan, rich purple.
The Governor, blush-white.
Vivid, fiery scarlet.
W. F. Milner, pure white.

Fancy Carnations and Picotees.

Adonis, flaked bright crim.
Alice Waite, yellow ground, crimson edge.
Eurydice, crimson and rosy purple.
Flavius, bright yellow, edged scarlet.
Hector, scarlet and maroon.
Hon. Mary Lascelles, yellow ground, edged crimson.
Huson Morris, rich crimson and maroon.
Janira, yellow and dark maroon.
Mrs. Mostyn Owen, crimson and dark purple.
Mrs. W. L. Walker, rose and crimson.
Prince Hal, plum-purple flaked.
R. Markham Hill, carnation flaked with maroon.
Saturn, chocolate, purple flake.
Sir Toby Belch, scarlet and maroon.
Thomas Page, yellow ground, edged with pink.

SUBURBAN GARDENING.

By James Hudson.

TERRACES AND ROWS OF HOUSES.

UNDER this heading we purpose in the first place to give a general outline of the laying out of the garden plots connected with this description of house, afterwards entering into their general management, simplifying the latter as far as we can in such a way that the owners of such plots of ground may be able to attend to the requirements of their garden plants themselves to a great extent. Such gardens as these are almost invariably of very limited dimensions. Here and there we meet with exceptions, in which the occupant is more fortunate than his neighbours in this respect; but concerning these larger gardens all the most necessary and useful hints may be gained in the perusal of our previous remarks on semi-detached villa gardens so far as regards their arrangement, while cultivation will be gone into in combination with the smaller gardens now more especially under consideration.

The Forecourt.—In the first place we will suppose that there is a small space of ground at disposal on the front, or road side, of houses built in terraces. This could be laid out in different ways, having regard to the aspect in selecting the subjects wherewith to plant the same. If the plot is very limited, it would not be advisable to lay any of it down in grass, as it would of necessity be so small a piece that when requiring to be mown, no machine, if ever so small, could be worked with any comfort. The use of the scythe requiring some practice to manipulate it in a skilful manner, almost forbids the use of that implement, and recourse would have to be had to garden shears, which would be found rather back-aching work to those who are not accustomed to the use of such tools. There is a more modern invention for small pieces of grass, after the pattern of horse-clipping machines, but of this we cannot speak from experience. The best way would be to have either a central plant with a little circular border around it, then a narrow walk next the same, filling up the angles with low-growing shrubs or hardy ferns, allowing of course for the broader path that forms the entrance to the house on one side or the other, as the case may be; or dispense with the central plant, and have a circle in gravel, and thus leave rather more room for plants and shrubs around this space. In lieu of either one or the other of these suggestions, a vase of average dimensions may be arranged so as to have a very pretty effect; this, however, entails closer attention with regard to watering. When this is seen to with regularity, we would prefer the vase as a central arrangement. It could be filled with hardy plants all the year round, or changed to suit each season, using tender flowering plants for the summer time, and a small hardy shrub during the winter months, with some few small plants of drooping habit to hang around the edges. This is a point that is often overlooked in vase arrangements, no provision being made for these suitable additions. If situated where much under the influence of the fogs and blacks that pervade the atmosphere around our towns and centres of activity, we would prefer edging-tiles instead of dwarf Box-edging, as the latter is not always satisfactory in such positions, whereas the former, if laid in a substantial manner in the first place, and of good material, will not need much further attention of any moment for some years. We would recommend the blue cable pattern of edging-tiles, as being both neat in appearance, and when of "terra-cotta" ware, of the most durable quality. Their non-absorbent properties cause them to withstand the injurious effects of frost, and though they may be rather more expensive in the first place, they will, in the long run, be found the cheaper. Box-edging also affords an excellent shelter for slugs and snails, which cause endless annoyance if not kept in check by every possible means. No plants should be employed on this side of the house that are of robust growth, and thus likely to require repeated prunings to keep them within bounds, unless used as a boundary line to the next garden. Low walls, with ornamented iron railings, are, however, the best means to employ in dividing one property from the others; these ought not to be so high as to shut out the vista from one garden to the other, for, it being impossible to keep such spaces of a strictly secluded character, the best way is to study the general appearance of the whole, which will be found far more enjoyable and of much better effect.

It seems a great pity the dividing walls in front of terrace houses cannot be abolished. They are no use for privacy or protection, and their removal would allow all the space of the forecourts to be treated as one whole, to much better extent and enjoyment. This, however, is impracticable in the present state of society and customs; and so long as the divisions are retained it is better to clothe them with verdure. To assist in this, a length of galvanised iron-wire netting of medium mesh can be strained from end to end. Before this is used to tie the plants against, two or three coats of paint would be a good preservative against any possible injury that might be caused by the galvanised wire coming into contact with the shoots of tender growth. If the houses are

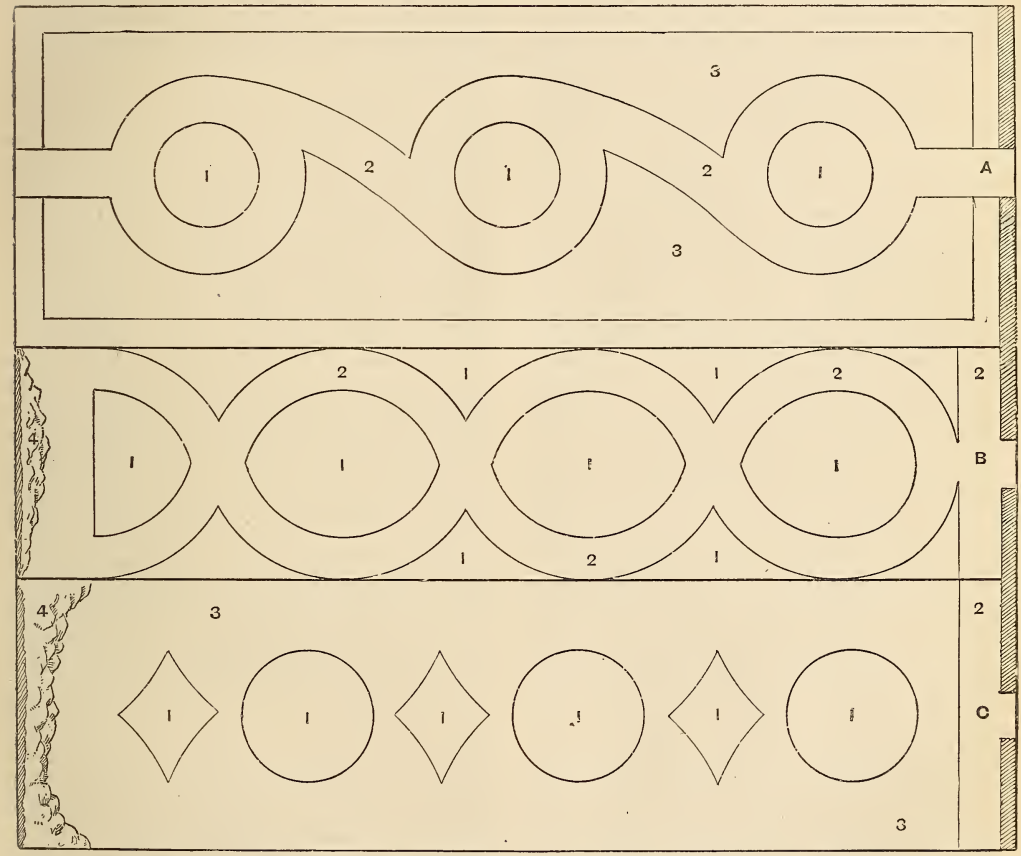
entered by a flight of steps, an excellent opportunity is afforded for a flower-vase on either one or both the top and bottom piers, whilst climbers can be trained up the side wall from one pier to the other. Provision should also be made by preparation with good soil (and drainage, if necessary, when lower than the surrounding ground) for suitable climbing plants to be trained up the walls of the house, which will always have a good effect when so covered; still more so if a balcony should be running through any part of the second storey. If the front door be somewhat projecting beyond the usual building line, or bow windows have to be dealt with, very pretty effects can be made by entwining climbers around the columns of the former, and by using those of evergreen character for training up the chief supports of the latter. Having regard to any possible injury, which will hardly be avoided when recourse is had to securing the climbing plants with nails and shreds, we would advise either a wire trellis for fixing against the walls, or some permanent studs to be driven in equi-distant from each other, to which the climbers, and other plants that require support, may be tied with ease. This recommendation will hold equally good for any space at disposal on the boundary walls of the property. The use of nails and shreds may answer very well when done by experienced hands, but far too many of each are invariably used by those who are not practised in their application. By omitting to draw out those nails that have become useless, the walls will eventually be rendered unsightly when deciduous climbers are denuded of their leaves. Where any quantity of old nails are thus found in walls, it is desirable that they should be withdrawn; this can be done far more easily by first giving the nail a rap as if it were intended to drive it further home. It will thus be released from any corrosion that has adhered to it by long continuance in the wall, and afterwards be drawn out in a far cleaner manner. When recourse is had to nails and shreds, be careful to allow a good space around the branch (when applying the shred to it) for future growth; or, in plain words, do not draw the shred tightly together and drive the nail close up to the branch. When tying mediums are used for securing the shoots against wire trellises or studs, small tar-yarn is the best material with which to perform the operation. Be careful also in the application of this means of support, to allow plenty of room for the future increase in the size of the branches. Good tar-string will last for several seasons; in its use, therefore, it is very essential that the advice we have just given be always borne in mind, or eventually the string will cut into the branch as the latter increases in size.

The Back Garden.—In resuming our remarks on the arrangement of the garden, after the foregoing necessary advice for securing the climbing plants, we will pass on to the garden plot situated on the other side, or back, of the house. In very many cases this, too, will be of most limited area—oftentimes only a square plot, when the backs of two rows of houses abut against each other. There will, perhaps, be room enough for a piece to be laid down in grass in the centre; when this plan is followed, we should not advise any space to be occupied with paths, but utilise *all* the remainder for shrubs and border flowers. If paths are allowed for, so much of the room will be taken up with these and the lawn plot that but little space will be available for anything else. If of fairly good width, a flower-bed can be allowed for in the centre; or, in lieu thereof, a few choice shrubs, or a Weeping Ash, which will afford a pleasing shade during the summer after a few years' growth. Limes are often planted in small gardens, but they are not to be recommended where the surrounding property is covered with houses, as their foliage has a peculiar propensity for retaining any deposit of dust or blacks, even after a heavy rain. No doubt this is further accelerated by the insects that frequent them, these leaving behind a glutinous matter to which anything will readily adhere. Trees with smooth leaves of a glossy shining surface will keep the cleanest, and the Planes are much better in this respect than the Limes.

In these gardens, of very limited extent, there will not be room for many shrubs; the idea, therefore, of endeavouring to obtain "seclusion" by the aid of such will not be possible of attainment. In endeavouring to attain to this end, the greater part of the ground would have to be occupied, leaving but little room for anything else. Attention should, therefore, be directed to securing such subjects as will give the best return in a small way. We would prefer to plant the tallest shrubs at the bottom of the grounds when another garden joins up to it; this will also give the best effect from the house. With a small lawn, and no paths allowed for, there would, however, be in many cases room enough at least for some few shrubs of moderate size on each side and near the division walls. We would not on any account plant up too closely to these walls in the case of any shrubs that may be chosen, but allow sufficient room for climbers throughout the entire length on either side. By planting the Irish Ivies or Virginian Creepers against these walls, and extending them beyond the top of the wall by the aid of ornamental trellis-work, a fairly good screen will be obtained which will not occupy any valuable space. When such a screen is not deemed necessary, we would rather advise the walls to be covered with

choicer plants, selected from such subjects as may reasonably be expected to give a fair return either in flowers or berries. *Pyrus Japonica*, the Honeysuckles, the climbing Roses, the Clematis, the Wistaria, *Jasminum nudiflorum*, flowering in the winter and early spring, and *J. officinale* during the summer months; the Cotoneasters; the Cratægus, beautiful during the winter when laden with its

for climbers of robust growth, such as the Wistaria, the evergreen and deciduous Magnolias, *Garrya elliptica*, and the Passion-flower (*Passiflora cærulea*). We strongly urge that every available foot of wall surface that is accessible be furnished with climbers, so that the utmost possible return may be secured out of such limited spaces as town and suburban gardens afford.



Plans for Back Gardens in Terrace Houses.
1, Beds; 2, gravel; 3, grass; 4, shrubbery or rock-work to hide bottom wall.

brilliantly coloured berries, and suited for a north or east aspect; and the *Euonymus latifolius* for its foliage, where nothing else besides the Ivy will thrive, will each and all give satisfaction. The evergreens should be judiciously intermixed with the deciduous species, but a list of each will be more fully given when we come more specially to consider that part of the subject.

Against the walls of the house more room will generally be found on the garden side of the building

By occupying only a limited portion of the side borders with shrubs of a bush form, there would be room enough for a fair quantity of flowering plants, such as the ordinary run of bedding plants, those of the herbaceous section, and annuals even, when it is not deemed necessary to have many of the first-named kinds. The shrubs as they increase in size will occupy too much room, and it will be better then to exchange them for smaller ones than to allow this increase in size to go on.

Planning.—If it is not deemed expedient to reserve the central portion for laying down in grass, but instead thereof to make more provision for flowers and ornamental subjects, rather than adopt the usual plan we would advise one *central* path throughout the entire length, or to be intercepted in the centre of it by fixing on that spot for an effective flower-vase. This latter plan would aid in breaking up the uniformity of a straight path from top to bottom of the garden. A circular bed could be allowed for around this vase, which should be made to look as gay as possible. Were it not for the high water-rates another alternative would be appropriately suggested instead of the flower-vase and bed, viz., to fix on that spot for a fountain. Such an object would be productive of good effect in that position, and if a basin of proportionate size were allowed for, there would be ample supply of water for all the garden requirements within easy access. Two short cross-walks could be arranged, one on each side of the fountain, and at right angles with the centre path. This would allow of four quarters, which could be more immediately devoted to the cultivation of garden favourites that will thrive in any particular locality. For the sake of convenience, two narrow paths of not more than one foot in width should be allowed for within easy reach of the climbers previously advised to be planted against the walls; this could be arranged between the shrubs. Four feet would be as much as could be conveniently spared in a small garden for a central path; somewhat wider should the garden fortunately be of more than average size. The shrubs should not be allowed to encroach within six feet of the path on either side, in order to allow a fairly broad border for Roses, and such other subjects, which thrive best when not overgrown or deprived of their proper means of sustenance by the proximity of the grosser-feeding roots of the trees and shrubs. In front of the Roses there would be a good position for some Pinks and Carnations, whilst the margins next the walk could be used for Pansies, London Pride (*Saxifraga umbrosa*), or one or more varieties of the Stone-crops (*Sedum*). Any durable edging plant that is neat and compact, would be preferable to using such as are tender and only fit to be seen for a few months of the year.

But other methods may be suggested. The great object to be aimed at, in getting any satisfaction out of these small strips of terrace-house garden, is to get rid of, to get right away from, the unendurable but customary monotony and endless repetition of a straight path all round the ground, about a yard from the wall. Small as the space is, there is no need for this wretched pattern to be always repeated in it, as we will try to show by a few examples; and this alike whether the garden is laid down in gravel or grass. To return for one moment to that question, much as we prefer grass where space is limited, it has a very serious drawback in large towns—that of not getting dry till the day is far spent. Bright and clear gravel, on the contrary, is accessible at all hours, from early morn till dewy eve, seasons when the garden is most enjoyable, but when grass alone must forbid its use to delicate women and children. So important to these for air, health, and happiness, is free access to the back garden in a town, that rather than deprive them of it we would lay down our pen and give up the ground to sheer gravel space and a swing. But this is not necessary; only give fair gravel space in the garden, and children may easily be trained to amuse themselves among flowers, and so to love and admire as never to wantonly injure them. Where there are children, therefore, adequate gravel walks there must and ought to be; since to be unable to run about because the grass is too long or too damp is to them sheer misery. At the same time, even a little really fresh grass, at a time when parks and pleasure-grounds are brown with drought, and the street is hot and dusty, is one of the greatest pleasures and refreshments of a garden, and can be easily enjoyed, if only on a small scale. To enjoy it, however, the turf must be watered almost daily in dry weather; and if this is done in the morning before going to business, the lawn will be found in the most perfect state for enjoyment in the evening.

We give a few plans merely as suggestions, and to show how easy it is, even in a small space, to get away from that intolerable monotony we have spoken of. By a small space we mean a plot of ground that is not perhaps wider than eighteen to thirty feet—few terrace-houses are narrower than the former, and something may be done even with that, quite apart from the plan of all-over grass and surrounding shrubs already spoken of. The three designs are purposely very different, and might easily be varied in detail, even with the same main features. That shown at A readily adapts itself to rather a wide piece of ground, or by removing the border and reducing in scale, to the narrowest. It furnishes almost the maximum length of walk in the minimum of space, in pleasing variety of line, and enables one to return at any point without retracing steps. It also allows a large-*looking* expanse of grass, from which the narrow flower border next to the side-walls very little detracts. The plan at B accomplishes somewhat of the same objects in a very different manner, and either this or C will suit the very narrowest gardens. The paths in B occupy more of the space, and may be either laid down so that all the other spaces, margins as well as oval centre beds, are in

flower-bed and border, or all these spaces may be in grass; or the ovals in flower-bed, and the borders grass, or *vice versâ*. This plan also allows of convenient return. A pretty variety may be got by laying the centre oval *alone* in grass, with a vase in the centre.

The design at C looks best as a grass design, on which the beds are planned, the turf being carried right up to the walls. The effect of even a very narrow garden so treated is very pleasing. Of course there may be also a narrow border under the walls; but if these are well covered with green, the grass alone looks best.

In all the above plans, the central oval or circle may, if convenient, be devoted to such a fountain or vase as already suggested. Both A and C may be made exceedingly pretty and effective in this way, but if a fountain were placed in B it would be better to make the central part circular rather than oval—this would at the same time give a little more variety to the design. We trust these hints will be sufficient to stimulate the ingenuity of the reader.

Paths.—The walks in such an arrangement as this would in many cases be made of gravel; these of necessity require attention in rolling and weeding. This labour might be saved by laying the walks or paths down in asphalt, which, if done in the first place in a substantial manner, would last for years without any further trouble beyond sweeping occasionally. The manner in which these paths are now laid down and faced off to resemble a gravel path as nearly as possible, commends the method strongly to the owners of small gardens, who always like to see their walks neat and clean, likewise fit to walk upon at any time. For further details under this head see special articles thereon.

Planting.—In such gardens as these we should never advise the planting of any great quantity of *bedding* plants. The short season at the best does not give a commensurate return, when it is taken into consideration that other plants of a far more permanent character have to make way for them. This, where the space is so limited, is a great mistake, there being no room for a reserve garden to supply the bare places when the first frosts of autumn have destroyed the beauties of the bedding plants. It will be far better to rely on plants of a hardy constitution, which, if not presenting quite such a display at any one time, will at all times have something to attract the notice.

We strongly urge upon those who are planting their gardens to secure a few good shrubs with variegated foliage. In a small garden they will look bright and cheerful; such, for instance, as the gold and silver forms of variegated Hollies; the Aucuba; the variegated Euonymus, including the dwarf-growing variety (*E. radicans variegata*). This is a pretty, neat dwarf plant for edgings, or for planting on rock-work; the variegated Vincas or Periwinkles too would be useful in a similar position. Prominence should also be given to the small and compact-growing types of Coniferous shrubs (*Coniferæ*) which retain their good appearance the year round. Of these plants the Yews are the hardiest and most enduring of any, bearing repeated prunings to keep them within the necessary bounds of a small garden. The common English Yew (*Taxus baccata*), and its golden and silver forms, are the best to select; the two latter, but especially the former of the two, have a beautiful appearance when the growth is being developed during the early summer months, presenting almost as good an effect as the presence of an abundant crop of flowers would do, but lasting much longer. The Yew is also one of the most accommodating of all shrubs for growing or training into fanciful designs, examples of which are frequently to be met with in country villages. The Box-tree can also be applied to the same purpose. Of other Conifers the compact-growing forms of *Arbor vitæ* are most useful, *Biota aurea* being one of the best, and taking several years to arrive at an inconvenient size; it is also called the Golden Arbor-vitæ, from the colour its young growths assume during the earlier stages. Of these, however, the Cupressus, and the Retinosporas (from Japan), which are somewhat similar, but yet of equal value by reason of their very neat appearance, we hope to give a more complete list later on. As a plant for a single specimen, the Araucaria (Chili Pine) is one of the best that can be chosen. This will succeed better when planted in a small state, and where it has a fair amount of room for expansion. In the suburbs, the Deodar, or *Cedrus deodara*, would also grow well, and make a pretty plant for the centre of a lawn, but when in closer proximity to the smoke it does not give satisfaction.

It will also be very necessary to pay attention to a selection of both deciduous and evergreen shrubs which are valuable for the sake of the flowers they produce. The size of the garden must be considered in the choice of these. The best of the freely-flowering Roses should of course have a prominent position; give them, in fact, the best places that can be found. The Lilac is another favourite, but will soon grow too large and rampant if not constantly kept in check by a careful use of the knife. The Mock Orange is another beautifully perfumed flower; this shrub will bear a liberal use of the pruning-knife, and still produce its flowers; do not cut it,

however, into a formal shape (neither should this be done with any shrubs), but reduce its dimensions by a careful thinning process. The scarlet, pink, and white-flowering varieties of Hawthorn (both single and double forms) are always welcome in the spring; these should be selected as standards on clean and straight stems; in which way they will not occupy so much room. The Chinese and Siberian Crabs also produce their flowers freely in the spring months; standards of these would be the best to select. There are also the showy early-flowering varieties of the double-blossomed Peach, one or two of which would be very useful, as well as the more common Almond, more hardy and floriferous. The Weigelia, too, is most effective, bearing the use of the knife to keep it within bounds. The hardy Azaleas, chiefly the yellow varieties, which are the most vigorous and floriferous, should receive attention. The beautiful tints of the leaves of the yellow kinds are almost equal to a crop of flower when they show signs of ripening, some few weeks ere they fall to the ground. These Azaleas should be associated with the Rhododendrons, and other shrubs commonly called "American" plants.

Of the Rhododendrons, a few words in their favour are necessary. Not only are they among the best of all evergreens, but they have such handsome flower trusses as should alone cause them to be always chosen in preference to either the common Laurel or the Portugal variety, which grow far too strong and luxuriant when once established in the fresh soil, whilst the Rhododendron will take some years before getting of unwieldy size. We have often been surprised when viewing such gardens as these, and even larger ones, to see what a want there has been of this fine evergreen shrub in the grounds. Coming as they do from elevated and exposed regions (those types at least which are designated as "hardy kinds"), they are among the best evergreens to withstand the occasional severity of our winters.

Thanks to the energies of plant collectors, who risk their lives, and oftentimes ruin their constitutions, by exposure in foreign climes, our gardens have been greatly enriched from time to time by the shrubs and plants which they have gathered and sent home to add to our collections. Among hardy evergreen shrubs, the *Aucuba Japonica* (commonly called the Spotted Laurel) is a notable instance of this, being a plant indigenous to Japan, which has now become thoroughly acclimatised in this country. Many among us can still recollect when it was first brought into prominent notice, and it is now to be found, more or less, in nearly every garden. It is a shrub which is thoroughly at home in the midst of our towns and cities, thriving there as well as in the pure country air. It will generally form itself into a compact bush without much attention, but should any shoots show a disposition to run away from the rest, they should have their tops taken off. And now that both sexes of this shrub have been introduced it fruits freely, and the berries are even more beautiful than the foliage, which is saying a great deal. There are many hybrid varieties with foliage and fruits of the most brilliant red, *A. Japonica vera fœmina* being one of the most fruitful. *A. J. longifolia* is also fine; and one plant of *A. J. mascula* will be found enough for the largest garden.

When a plant gets to a large size, and some branches droop on the ground, or are of sufficient length to be brought in contact therewith, they may be pegged down into a little extra good soil, having first cut about one-third through the stem, in a slanting direction, where it will be buried in the earth in the after-operation. These shoots will soon take root, and partially rely on their own resources; when indications are apparent of their having a good quantity of roots of their own, they may be severed from the parent plant. Leave them thus for a time before attempting removal; the check in both ways at once would be too much, perhaps, for the future well-being of the plant. These young plants would be found useful to replace any which are getting too large for their positions, yet not too large, perhaps, for removal to some other part of the garden, there to be used in the place of huge overgrown specimens, valuable in their way in a large garden, but quite out of place in a small one. No *large* tree, plant, or shrub should be permitted in a small garden; they so soon impoverish the soil, making it quite unfit for many other subjects which it is desirable to cultivate as successfully as possible.

HERBS AND SMALL SALADS.

By William Earley.

Mustard (*Sinapis alba*). French, *Sénevé;* German, *Senf;* Italian *Senapa.*—This is the common plant used so generally and plentifully, along with cress, already referred to, in connection with salads, and otherwise. Its simple culture into the seed-leaf consists of merely sowing the seeds thickly upon the surface of the ground, and placing the slightest possible amount of fresh soil over them, when they are well watered and kept constantly moist. For the earliest sowing out of doors, which should commence about the beginning of May each year, a warm, sunny border should be chosen, and for midsummer and early autumn a moist, cool site. To insure a constant supply subsequently during the

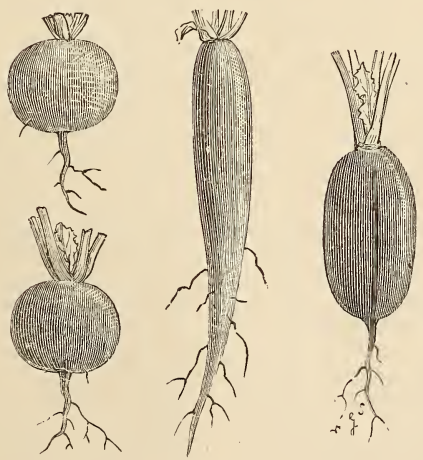
winter months, periodical sowings must be made in the same manner in shallow boxes as frequently as the demand suggests.

Onions, small, for salading, require to be sown in small beds monthly, where they are in demand, though Chives, already referred to, can be very conveniently made to take their place. They should be drawn when quite young, or so soon as the third leaf forms. The variety named "The Queen," being such a rapid grower, is excellent for this purpose. For general culture, see "Onion," in the main list of vegetables.

Curled Parsley.

Parsley (*Petroselinum sativum*). French, *Persil;* German, *Petersilie;* Italian, *Petroselino.* — The Parsley would appear the most indispensable of all so-called pot-herbs, no garden being supposed complete without a good supply at all seasons. It comprises the ordinary or pot-herb, and the "Hamburg" or "large-rooted" variety (*Petroselinum sativum latifolium*). The former or commoner form is very easily cultivated so as to secure constant crops. Any kind of garden soil will suffice, though the deeper and better the loam it consists of, so much the finer will be each plant and its leaves. A firm soil, having been some time previously well enriched with manure, gives better results than such as are too sandy or loose in their nature. The first sowing should be made early in the month of February upon a favourite site, and a second during the month of May. By keeping the plants which result from such sowings frequently denuded of all large leaves, even to taking the heart of each plant out as it shows symptoms of undue growth and a likelihood to run to seed, a constant succession of young leaves will be formed.

Sufficient care to sow and hoe out thinly is not generally observed. Each plant grown from a good stock of seed, especially where the ground is good, should be permitted at least nine inches of space to grow upon. The too common practice is to sow very thickly to insure a crop, and total neglect to subsequently thin out the young seedlings. The result is that the whole bed becomes checked during dry weather, and the whole runs away to seed. It is even better to transplant a sufficient width for the supply, than to allow this; though sowing more thinly, and thinning the young seedplants out, is more likely to give excellence of quality and supply. If at all required for garnishing as well as for potable purposes, care should be taken to procure seed of a well-curled variety.



Radishes.

Hamburg Parsley (*Petroselinum sativum*, var. *latifolium*). — This variety should be grown upon ground in precisely the same way as the Parsnip crop, as the roots grow to almost as large a size. Seeds should be sown, thinly, in drill rows ten inches asunder, and for succession, during the months of February and June. So soon as the young plants are large enough, thin them out to eight inches apart, and then frequently hoe amongst them subsequently. The roots produced from the earliest sowing will be ready for use by the month of August, and afford a supply subsequently, according to the quantity grown, onward throughout the winter months.

Purslane (*Portulaca oleracea*). French, *Pourpier;* German, *Portulak;* Italian, *Porcellana.*—The

Purslane is an annual plant and a native of the more southern parts of America. It is used for salads, &c., though less frequently than formerly. It is in habit somewhat recumbent, like Portulacas generally. A somewhat red-tinted and a green variety exist. The latter is considered most hardy. For an early supply sow in pots, and transplant out on to a sunny site and a free sandy soil. Out-door sowings may be made in similar situations from May 20th, onward, according to demand. All plants should be planted or thinned out to distances of eight inches apart.

Radish (*Raphanus sativus*). French, *Radis*, or *Petit Rave;* German, *Rettig*, or *Radieschen;* Spanish, *Rahano.*—The Radish is probably one of the most generally esteemed, grown, and used amongst all salad plants. Being so perfectly hardy, easily grown, tender, and piquant, it enjoys a just popularity. A highly enriched free or sandy loam suits it admirably, though it will grow in almost any kind of moderately good soil. To succeed thoroughly in its culture, however, the space intended for the successional crops should be liberally manured and dug up deeply, as soon after the month of November as possible. Let the surface lie quite rough and fully exposed to the winter until the time for sowing in the early spring months. Sowings to be made at that time must be influenced by the consideration whether any are to be frame-grown or forced for the earliest supply, or not. When such is the case, a good sowing of seeds should be made about one month before the frame-grown crop is likely to be all used. On the contrary, where frame culture is not resorted to, an early sowing should be made during a mild interval towards the end of the month of February. This sowing should be made upon a warm sunny aspect, and the seed-bed covered over thinly with straw until germination commences. Afterwards mats should be placed over them upon hoops during sharp weather. Other sowings, which will not require such assistance, should be made during the month of March, and near to the 10th and 25th of the month, from which time forward slight sowings should be made about every eight days.

It is the need of these frequent sowings which causes crops to be so irrregular in the matter of quality and quantity. Sowings made at too long intervals apart result in fluctuative crops of produce often old, tough, and stringy. A Radish to be meritorious must be quickly grown into goodly size, and used when ready. Length or size does not constitute merit, and all but invariably they are permitted to grow too old before being drawn.

As the season advances and dry weather prevails, it is imperative to keep the beds well watered, and it is owing to the need of this that good crops are rarely obtainable after the summer season has once set in. There is an excellent method of obtaining good produce early wherever large heaps of manure, with the heat somewhat exhausted, lie around, as they do in connection with farmyards, &c., generally. By simply placing six inches of soil over the surface of such, and sowing seeds thereon, a rapidly formed crop of no mean merit will result. The Turnip-rooted varieties are hardiest, and may with advantage be sown for late autumn and winter crops; sowings for which should be made during the months of October and November.

Radishes are only perfectly and really tender before the third and fourth or rough leaves expand, or grow; and in view of having a goodly-sized root-base or radix, prior to the formation of such, it is very essential that the soil be deep, fine, and rich as advised, and that each plant have ample space to grow in. Thick sowing and its results are very antagonistic, and must not be permitted.

Besides the root-base, the rough leaves upon these, when so far advanced as to produce them, are also severed from the plants and used in salads. The Turnip-fly often attacks them at that stage, and must be kept at bay by thin dustings with lime or soot, at such times as the leaves are damp with the dew of early morning.

Frame-grown, or forced Radishes, require a bed of fermenting material, as a base, covered over with soil and a frame, the former in depth according to the earliness or otherwise of the season when seeds are sown. And this may range between the months of December and March inclusive. Where the operation is undertaken, however, it is injudicious to be late. For December the bed should consist of about three feet of fermenting materials, and it may be reduced by one foot or rather less per month as the season advances towards April. A slight warmth only is needed within, though a sufficiency of material should be placed together to keep any prevailing severe frosts at bay. Upon the fermenting material, six inches of such soil as suggested above must be placed, elevating all up near to the glass, and the seeds sown. Shut down close until germination commences. Give air constantly afterwards as the weather permits, maintaining a mean warmth of about 50° within the space of the frame. This will be ample, assuming that more warmth exists in the bed. The latter will conduce to more active lower growth than of surface or leaf, which will be advantageous; good root-waterings with tepid water must be given as needed, care being taken to thin them out if too thick. Potatoes may be planted beneath, or Radishes may be sown in Potato-frames.

As regards varieties, a great improvement has been made during the last decade. Intermediate forms of globular shape are amongst the best, and are named French Breakfast, Rose Globe, Olive Scarlet, Olive Violet, &c. Long-rooted varieties are best represented by Long Scarlet, Short-top, and Long Salmon. For frame-work, Wood's Early; and for autumn sowing for winter use, China Rose and Black Spanish, with ordinary red and white Turnip. A large-rooted variety (white), resembling in size the Paris Market Turnip, named Californian Mammoth, is useful also for winter, where sliced Radish is acceptable. Seeds of this species should be sown in shallow drill-rows, about July 20th and August 1st, for successional supply.

Rampion (*Campanula rapunculus*). French, *Raiponce;* German, *Rapunzel;* Italian, *Raperonzo.*—This plant is a biennial, and a native of Britain, and is a rare exception as being an edible root amongst Bell-flowers, or Campanulas. While falling in alphabetical order, it also comes conveniently after the Radish above, as the root when well grown greatly resembles it, is white in colour, and of a more nutty flavour. Its cultivation is not so general as it used to be. This, no doubt, is owing to the fact that, under the old careless system of culture, the roots produced were more like eagle's claws, or a bundle of large roots, than straight like the Radish; the result being that they were with difficulty prepared for table, and when so prepared they appeared of irregular and indefinable shape. The root is also used in the salad-bowl, along with the tender young leaves, which are formed in dense tufts.

Prepare a bed for the seed in a somewhat shady situation. The soil should be finely worked to a depth of eight inches, and at the bottom of this a layer of decayed manure should be placed. Poor sandy soil will suit best above this manure, as it will induce the young first root to grow straight down without unduly branching. Sow the seeds about the second week in May. As these are very small, do not rake the bed over afterwards, but give the surface a good watering with a fine-rosed watering-pot to settle the seeds down. So soon as the young seedlings appear, give another watering should the weather prove dry, and subsequent ones as necessary. Each watering given must be so copious, however, as to penetrate down throughout the layer of soil above the manure. When the seedling plants come up too thickly, thin them out to distances of three inches apart. By choosing from amongst such seedling plants such as possess straight roots, and transplanting them into a rich bed, taking care to make deep holes, and insert the young roots straight to their depth therein, excellent produce may be secured. The roots require scraping before they are ready for use.

Rosemary (*Rosmarinus officinalis*). French, *Romarin;* German, *Rosmarin;* Italian, *Rosmarino.*—The well-known and cultivated Rosemary once existed in all but every garden. Even to this present date it is very generally grown in the West of England, the Principality, &c. The plant is generally propagated by means of seed-sowing. These are sown upon a warm, sunny border. But another common method is to draw downward young side-shoots, which exist around the main stem, so abruptly as to detach the young shoot with

Rosemary.

a heel attached, to cut away the jagged edges neatly, and to then dibble them out into a moist situation, and shady, during the early spring and summer months. Place such cuttings in moderately deep, and press the soil very firmly around their base. These will have rooted freely by the early autumn. Whether propagated thus, or increased as seedlings, choose a damp period early in the month of October, and transplant them into their permanent quarters. They succeed best upon light, dry soil, and, in more northern counties, beside low fences, &c. A very few plants, if pruned back annually after the flowering season, will suffice. There are the green-leaved, the silver, and gold-leaved varieties.

Sage (*Salvia officinalis*). French, *Sauge;* German, *Salbei;* Italian, *Salvia.*—In the Sage we possess a dwarf evergreen shrub, introduced from the South of Europe, and hardy enough to withstand all ordinary British winters, though it is some-

times destroyed during very severe ones. Its uses are too well known to require reference herein. The quickest and best mode of propagation consists of striking cuttings of the young growing shoots during the month of May. The plants resulting from these are more quickly grown and robust than when slips or more matured side-shoots are torn away from the plants and dibbled into the ground, which is a convenient method where pots and glass coverings do not exist. The cuttings should be about four joints in length, cut off immediately beneath the lowermost pair of leaves. Inserted into sandy soil tightly, and kept close, or warm, in pit or frame for a short time, they root very quickly, and are soon ready for finally transplanting out into the permanent bed. To propagate the plant by means of the more matured slips, they should be slipped off neatly, and should consist of the shortest side-shoots. Then cut away any rough edge from the base of the wound, remove all old leaves up to the upper two or three pairs, and dibble each deeply, or up to the base of the lowermost leaves existing upon each, in a shady border. When these are rooted and commence growing, prepare a bed for them in any part of the garden where full or partial sunshine exists, and plant the young plants thereon in rows, leaving one foot between each plant. During all after-culture care must be taken to keep them periodically cut down, or the points of all strong leading shoots must be removed, or the plants will rapidly assume a too long or leggy form. The practice of cutting down the plants in the early autumn is beneficial to the plants in this regard, if it be but done at a time convenient for future growth, which should be established prior to winter. This process should be performed towards the end of July, at such time as the plant shows a disposition to flower, when all flowering shoots should be removed at their base. In pruning them down, however, take care to leave a few growing shoots around the base, as an aid to the plant's future progress.

Savory, Summer and Winter (*Satureja hortensis* and *S. montana*). French, *Sariette ;* German, *Saturei ;* Italian, *Satoreggia.*—The Summer Savory is a hardy annual, and a native of Italy. It is grown from seeds sown annually during the early part of the month of April. The plant delights in a sunny situation and a deep rich soil. So soon as the seedling plants are large enough, thin them out to six inches apart. This will define the distance requisite between rows when the seeds are sown in drills, as is sometimes advisable.

Winter Savory is a dwarf hardy shrub, introduced also from the South of Europe. To secure a stock of it, seeds may be sown as directed above for Summer Savory ; the young seedling plants to be subsequently, when large enough, transplanted on to a similar site at one-foot distances apart. So soon as growth recommences in this newly-planted bed, take off the points of each, to induce a bushy growth. It will be desirable to choose a showery period during the month of June, should the plants be large enough for such transplanting.

To propagate this Winter Savory otherwise than from seeds, old plants may be divided, or cuttings formed of the young side-shoots, consisting of a portion of old wood, dibbled out into a shady border, as advised for Sage.

SAGE.

Skirret (*Sium Sisarum*). French, *Chervis ;* German, *Zuckerwurzel ;* Italian, *Sisaro.*—The Skirret, or Crummock as it is occasionally called, is a perennial, having generally somewhat divided enlarged roots, which are cooked and used after the manner of Salsify, &c. The plant was at one time far more popular than at present. The roots may be said to be pure white and of very pleasant flavour. Seeds should be sown in drill-rows eight or nine inches apart, about April 10th, and when the plants are large enough thin them out to seven inches apart in the rows. A light stony or sandy soil well worked, and with a layer of manure seven or eight inches deep, is most likely to produce roots with limited branches. The plant being a perennial, as stated above, can also be propagated by means of root-divisions. Any side-roots which can be detached from the stools, dibbled out into similar soil to the above, at any time when the stools are large enough, and they have not run to seed, will produce examples in all ways fit for culinary uses.

Sorrel (*Rumex scutatus* and *Rumex Acetosa*). French, *Oseille;* German, *Sauerampfer;* Italian, *Acetosa.*—We find here a generally grown and well-known plant; the normal form of one, the latter species named above, being a very common weed in British pasture-lands. The former is a native of Southern Europe. Greatly improved varieties of both are in general cultivation. The *Rumex scutatus* requires a deep rich soil to develop its characteristics of large leaves, &c., thoroughly. The latter or British species will thrive in any soil, though a moist and moderately enriched one always gives the largest and most succulent leaves. These last are used for salads, and variously besides. They are propagated both by means of seeds and division of the old plants. The latter is most commonly resorted to, though fine plants are produced as seedlings. Seeds when sown should be placed thinly in shallow drill-rows six inches apart, and the seedling plants thinned out to equal distances when large enough. The former, or round-leaved species, having more repent roots, and as it spreads more, should have rather more room in deep, rich, mellow soil. When propagation takes place by root-division, do not cut them up into too small pieces; prepare the bed deeply and well by abundant manuring; plant twelve inches apart. During the whole of the summer months all flower-stalks should be cut away immediately they appear, and when the growing leaves are not cut for use with moderate regularity, it is needful to cut them down just the same, when they become somewhat aged, to insure successions of young leaves.

THYME.

Thyme (*Thymus vulgaris*). French, *Thym;* German, *Thimian;* Italian, *Timo.*—The garden or common Thyme, introduced originally from Spain or Italy, has in many places become a self-sown native plant. As such it is of easy growth, having as it would appear, judging from the places chosen by wilding seedling plants whereon to grown, a predilection for dry places, even to the tops of stone or brick walls, &c. Nevertheless, it is not always found growing in any great luxuriance in gardens. The fact is, existing stocks are too often allowed to grow or run out, before young plants have been planted and subsequently had time to perfect their growth.

Under border culture the plant succeeds best in a light sandy soil, partly exposed to sunshine. It is increased by seed-sowing, by slips or side-shoots, having a few roots attached, and by division of the plants. When seeds are the medium employed, they should be sown broadcast upon such a soil as advised above, during the first week in the month of April. So soon as the young plants are large enough, thin them out to about four inches apart, and dibble such seedling plants as are drawn out from the bed, also in beds, or rows, to three-inch distances apart. If this operation of transplanting be performed late in June or in July, it will be necessary to thoroughly well water the young plants in.

When the plant is propagated by means of side-shoots or slips, choose always young shoots, as short and bushy as possible, which are generally to be found near the centre of the plants. This is best done during the early part of the month of April. Dibble them out firmly four inches apart, and well water them in also. Divisions of the old "stools" or plants, cut or pulled into about four parts, make the best or quickest plantations. It is desirable, however, in resorting to this method, to choose a new site for the bed, not to continue taking up and re-planting on the same spot perpetually.

In low damp situations, and where the ground is naturally heavy and tenacious, it is desirable to place a goodly quantity of old lime rubbish over the surface of the bed, and to dig it in deeply before planting it.

Thyme, Lemon (*Thymus citriodorus*) is a distinct species from the above; the leaves are larger, and the plant more spreading. It is desirable to treat it precisely as advised for the above.

Thyme should not be permitted to flower. Immediately this is perceptible, cut the plants down: the result will be that numerous young shoots will form and the plants become more bushy towards autumn. A little rich soil sprinkled amongst the branches of all large plants assists growth greatly. The large-leaved variety of the common Thyme is best.

GROUND OPERATIONS.

DRAINAGE.

DRAINAGE is the most vitally important of all the many operations that can be performed on or in the ground. Among the latest discoveries in the many-sided art of cultivation, its theory and practice are as yet most imperfectly understood. Most that is known on the subject, not only by the general public, but even by those who live upon and by the land, is that drainage is a short and easy method of laying wet land dry. This is far less than half the truth. Other portions of it may be stated thus: drainage keeps land moist and warm, and by setting or keeping the water it contains, or receives, in motion, invests it with solvent powers and nutritive functions of the most valuable character. Water at rest—that is, stagnant—kills, by drowning out all the productive force of even the best land. Water in motion develops and augments the fertility of the very poorest soils, while it unlocks, and adds to, the food-stores already existing in the richest and best.

Cultivators of fields and gardens alike have been too much in the habit of looking upon water as a nuisance to be rid of at any cost. Grasping the broad fact that drainage had transformed some of the worst lands into the best, they have run their drains where they were not needed, and have been vastly astonished at their failures. Water that was in the process of being gradually, but surely, drained off by nature through her myriad outlets into the subsoil, carrying enrichment with it at every stage of its journey, was hurried off through new channels —the drains—into the nearest ditch or river, and nature's machinery for the amelioration and enrichment of the land thus rudely stopped. Almost the first step to the comprehension of the true theory and practice of drainage is recognition of the fact that water in motion, the free gift of nature, is the most powerful and beneficent of all natural forces, to be utilised to the very uttermost. It is the cultivator's capital—sinews of war—in the liberation and utilisation of the natural force of the soil, and should, therefore, be skilfully used. Like other capital, it is apt to run into aggregates, accumulate into masses, and the land-drainer's object and aim should be to effect its more equal distribution. In very few localities in this country is there really much excess of water for cultural purposes. The evil lies in its condition, not its amount. Give it motion, and in not a few gardens, especially those devoted to the culture of vegetables, the more water the better. Nor is this to be wondered at, for water is not only the builder up of vegetation, but it also constitutes from eighty to ninety per cent. of the materials—being to a very large extent not only water, but stone and mortar as well. But as reasonably expect a house or mansion to arise in the night—when the builders are fast asleep—as vegetation to thrive on water-logged land. In the latter case the active agent is not only asleep but dead, and only drainage can restore it to life, by setting it in motion and marrying the water to its better half, that other great natural life-giving, constructive, and solvent force, the air. Link these together through our drains, and set them out on their endless journey of discovery and production, and our gardens can hardly fail to be covered with plenty, filled with fragrance, and adorned with beauty.

If all this be true, and it is, then the true theory and practice of drainage may be stated thus: It lays land dry; it keeps it moist; it makes it warm; it frees, distributes, and adds to its wealth or richness; it improves its texture; it adds to its depth, and makes its cultivation more easy and pleasant, as well as more profitable.

Drainage Lays Land Dry.—The term is used comparatively, and simply means sufficiently dry for the successful cultivation of garden crops. Absolute dryness is neither possible nor desirable. But, on the other hand, it may be affirmed that no land that is undrained by nature or art is fit for horticultural purposes. Further, most land, unless it be a fen, or water-meadow, or a swamp, is already more or less thoroughly drained by nature. Faults and upheavals of strata, enormous beds of gravel, deposits of shells, pebbles, chalk, the regular or more erratic changes of level, the up-towering of mountains and hills, the deep depressions of plains, these are samples of nature's gigantic method of drainage; and the leaping waterfall, the sparkling rivulet, the broad brimming river, the ever full and mighty sea, are her tributary and gigantic outlets for the overflux water of the earth. Hence, natural drainage is after all the major note of the subject. Man in this matter, as in so many others, originates little or nothing. He is but a futile imitator at best, and the more perfect his imitation the greater his success. His main and arterial drainage are but babyish imitations at the most of the deep broad rivers and tributary streams that cut or plough their silver lines of beauty and utility all over the earth's surface, thus converting it into a reticulated pattern of verdant green and glistening silver. And though on the earth's cultivated surface, in field or garden, the green largely predominates, could the whole of nature's drainage system be laid bare before our eyes, the water lifted by innumerable hands (sunbeams) into the air, and the millions upon millions of trickling droplets

draining their way, literally paddling their own canoe towards finding their own level in obedience to that mightiest of all water-disturbing and distributing forces, the law of gravitation, it would be found that the silver matched, if it did not overmaster, the verdure.

The major part of this water, so much of it indeed that the word "all" might fairly be used, is like Tennyson's brook, flowing on and on for ever. And the main object of all this stupendous machinery in motion is to lay the land dry.

The land becomes wet from two sources. The overflow water from higher elevations sweeps down over the surface, and floods that of a lower level. Or, more generally, and in far larger quantities, it is absorbed by the surface, temporarily stored in the soil or subsoil, conveyed through fissures in the strata, and comes forth sometimes near to its source, at others at great distances from it, in lower springs. In these cases the water is said to rise from below, and it does so frequently to such an extent that the whole of the subsoil, and then the surface, thus becomes soured or saturated.

The first point in successful drainage, therefore, consists in cutting off these subterranean supplies, or, if that cannot be done, the carrying away of this foreign excess of water by drainage. In cases where the causes and source of this water can be traced, one main drain may often become almost sufficient to drain an entire field or garden. (See Fig. 11.) Frequently, when this foreign water is removed, the rainfall will not be found to be excessive.

Much will be found to depend upon the rainfall of the locality, and this varies as widely as from twenty to forty inches a year. The character of the soil and subsoil must also be taken into account. It is well, however, to test the matter by time, by the incline of the strata, &c. If the character of the soil and subsoil, and especially the conduct of the newly-made main drain by its fall and constant discharge, point to spring-water as the cause of the excessive wetness of the land, it will be wise to test the result by experience before going to the expense of draining off the surface or rain water. By one or both methods the drainage must be made so perfect as to dry the land sufficiently for cultural purposes.

As gardens cannot well be drained after they are formed without a heavy sacrifice of money and material, it is important to drain the ground before making them, and in all cases to give the drainage the benefit of any doubt that may exist about its necessity. Were the mere removal of the excess of water the one and only merit of drainage, this might be of less moment. But it is very nearly otherwise, and this leads to the second branch of the subject.

Drainage also Keeps Land Moist. — Drainage, by removing the excess, husbands a sufficiency of water; and in the case of garden soils, enough water is far better than a feast, that is, a flood. Any one at all conversant with the effects of drought on wet soils, must have observed that the merest mud of a month or so before is the very first soil to become as hard as brickbats under the dry-baking of a severe drought. So hard indeed does the wet soil become, that it rends into fragments and deep fissures rather than yield in the mass to the contracting powers of the drought. The mud of yesterday becomes the impracticable lumps and unbreakable clods of to-day, and as long as the drought lasts.

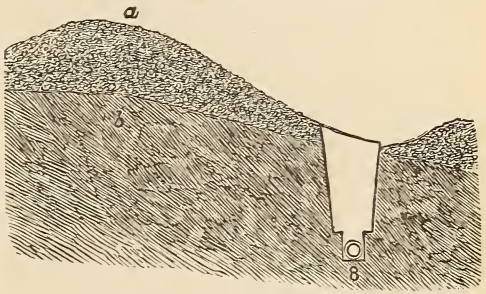


Fig. 11.—Drain at B, intercepting water delivered by falling strata from higher levels at *a* and *b*.

Nor are these drying effects merely seen in the mechanical behaviour or condition of wet lands under drought, but the crops are also the first to suffer, and to hoist unmistakable signs of distress on wet lands. Such lands are, in fact, the victims of unequal distribution. The drowned land of one month becomes the baked, parched land of the next, and so on and on continually until the drainer's spade and material set the water on a downward track, and thus distribute it equally all through the mass of earth. The passage of the water into deeper tilths moves it from the influence of wasteful dissipation by the sun and dry air. Every drop of water absorbed also so alters the character of the surface and substance of the earth as to make it more difficult for sun and wind to reach it.

Each drop of water, digging its own way to the drains, blocks the passage behind it with one or more molecules of air, thus making the soil porous, and within reasonable limits the more porous the earth the more moist, for air is one of the most powerful resisters of either heat, cold, or drought. Hence, while wet land may be sun-baked to a depth of several inches, properly drained loose-surfaced land may not be dried half an inch, and is seldom or never baked into hardness at all under the severest drought.

Besides, as the whole of the excess of water in undrained lands has to be lifted from the surface by

sun and air, this method of removing it becomes also a means of hardening the surface into a state of intractable sterility for the time being. The extra moisture in well-drained lands when it is most needed —*i.e.*, during long spells of drought—is not only matter of common observation, but the extra produce resulting from the drainage is almost entirely owing to this indirect or side influence of drainage. Undrained gardens and fields have no storehouse for surplus water, unless on the surface, where it is wasted by any wind that blows, or drunk up by every thirsty sunbeam. The storing-cisterns of drained land are deep and wide as the area of its tilths, and hence the provision of water enough and to spare for every cultural and climatic emergency.

Drainage also Makes Land Warm.—Of course primarily the sun is the great source of solar heat, and it has been so admirably arranged that the earth must be warmed before the air, which only gets its heat second-hand from the earth. Hence it follows that the warmer the earth the warmer the air, and also, as we experience in these temperate climes, the hotter the climate. It follows from this that the temperature of the earth becomes a matter of the most vital concern, not only to the plants that grow in it, but also to all that live on its surface. At first sight, on recognising the full force, unerring exactness, and stupendous powers of the great forces and laws that control all the arrangements for watering and warming the world, it seems presumptuous to suppose that any power of man can alter their character or modify their force. Every one, however, that drains a field or garden does so to a far greater extent than might be supposed. True, the absolute heat of the sun may be very much (not quite, however) the same, but the same amount of heat, which is always and everywhere equivalent to force, may be directed to different objects and, in fact, for different purposes. In this case the heat may be made a lifting power or a warming force, and what is expended on the former species of work cannot be also employed on the other. On undrained land much of the heat of the sun must necessarily be expended in lifting the excess of surface water from the earth. It has no choice of work; while that remains its removal must precede the warming of the ground. This lifting of the water causes an enormous expenditure of heat. Exact calculations would only puzzle the general reader, to whom we wish to be at once interesting, instructive, and attractive. Comparing the sun's force, then, to a steam-engine of 500 horse-power, it is no exaggeration to say that the strength of 400 horses would be expended in lifting the water from the surface, while that of only 100 is left to warm the earth.

Nor does that comparison by any means fairly represent the loss of heat resulting from the lack of drainage; for not only is all this heat wasted in lifting the water, but the lifting by evaporation—the only possible method in this case—is one of the most potent cooling processes known in nature. Even drinks and water can be cooled thus into ice in the tropics; and the same tendency and results, though not carried to the same extent simply because the evaporation is not so intensely active, is manifested at all times and in all places when water is lifted from the surface of the earth by evaporation. Using the simplest and broadest figures for the sake of illustration, it may be broadly asserted that if it takes three or four units of heat to lift a given weight of water, three or four units are lost to the earth as the water leaves its surface. Nor is this all the loss of caloric that water-logged land suffers. The earth is warmed by warm showers of rain as well as by the direct action of the sun on its surface; but these are prevented from penetrating and adding their warmth to undrained gardens. The water already in possession refuses to quit for the new-comer, and hence the warm rains are kept lying on the surface till lifted up again, to the further cooling of the earth.

But how is it that the rain-water cannot enter undrained land? The answer is of vital importance, and furnishes the most powerful of all possible arguments that can be advanced in favour of the thorough draining of gardens and fields. It is this: Water is heavier at a temperature of forty degrees than it is at any other temperature. Cold increases the weight or specific gravity of most substances and fluids in a regular ratio at all temperatures. Water forms a grand exception to this general law, the exception and its results being among the most marvellous provisions found in nature for the conservation of the heat of the earth. Though hardly germane to our subject, it may be briefly added in a sentence here, that had water increased in weight till it became solid ice, it would sink so soon as formed, and all rivers and seas in cold climes become solid instead of liquid. Such a result would have rendered the earth unfit for cultivation or the abode of man; for water, once cooled, can hardly be warmed from above. The experiment has been tried again and again of pouring boiling water on a mixture of soil and water. The heat cannot be passed downwards more than six inches or a foot, while in a vessel two or three feet deep the temperature at the bottom remains the same.

But place a stop-cock in the bottom of the vessel, and turn that as the water is added at top, and the entire mass is quickly heated to the same tempera-

ture, provided the hot water is poured on the top for a sufficient length of time. The undrained land is the mixture of drowned mud; the water in possession, by its mere superior weight, successfully resists the entrance of the lighter and warmer water. The drains are the opened stop-cocks, and these, once opened and kept open, allow the warm rain-water to percolate freely through the entire mass of soil, and thus raise its temperature to the level of the warm summer showers.

Nor are these views theoretical only. The rise of the general temperature of earth by drainage has been proved by direct experiments to be so very considerable as from five to fifteen degrees. It is impossible to estimate the enormous importance of such increased temperature on horticultural pursuits. A rise of ten degrees, or even five, in not a few gardens would make all the difference between the possibility or impossibility of growing or not growing such semi-tender fruits as peaches, nectarines, and apricots in the open air. And so also of any other garden crops, in which success or failure very often depends upon an increase of from two to five degrees of heat.

Besides, water-logged land is almost as cold in summer as in winter. Supposing the temperature of the stagnant water to be forty-four or forty-five degrees, the thawing of snow-water in the spring may probably reduce it to forty. Such water will prevent any summer rain from entering; hence the soil throughout the year remains almost of the same uniformly low temperature. And thus, while the tops of plants are being forced into vigorous growth by the genial heat of the summer air, the roots are chilled in earth not much more than eight or ten degrees above solid ice. It is little wonder that under such conditions the plants refuse to thrive, and the produce of gardens is inferior or worthless. Of course, drained lands are subject to greater alterations of temperature than those that are undrained; but this is a decided benefit to be desired, not an evil to be shunned. The nearer within reasonable limits the root and top temperatures can be assimilated, the better for the plants. Thoroughly drained lands are, on the whole, of a higher temperature than the air; but the tendency is towards equality. The absorption of the sun's heat, the penetration of summer showers, the warm delugings of thunderstorms, all tend to keep the earth in summer as warm or even warmer than the air. Taking the average mean temperature of the air at any given place, the heat of the earth on good soils will mostly be found to exceed that of the atmosphere by five or more degrees. A good deal, however, depends upon the colour and texture as well as the dryness of soils. Dark-coloured soils heat and also cool the soonest; while it is almost impossible for light soils to be warmed at all, especially if they are wet. These differences in the character, condition, and colouring of surfaces would have almost as much influence on the acceleration or retarding of crops as the temperature of the surrounding air, while the latter is also raised sometimes as much as ten or fifteen degrees by the mere act of draining wet land. The general climate of the Fens and other low-lying districts has been so much improved by drainage, as not only to double or treble the produce of the land, but to add greatly to the average length of human life.

Drainage also Sets Free, Distributes, and Adds to the Richness of Soils.—Water in motion is one of the most powerful distributing and carrying forces or agents. It has left the marks of its handiwork in beds of clay, gravel, and alluvial deposits of the richest character all over the world. It carries on the same kind of work, though on an infinitely smaller scale, in the smallest streamlets as in the broad deep rivers: that is, it breaks down and re-distributes the most soluble, and therefore the best, earthy particles it meets on its course. Water is not only a warmer, but a worker. Its cleaving force and solvent properties are wonderfully underrated. Each water-drop channels or cuts its own way towards the main or secondary drains. Doubtless in this work it is considerably assisted by earth-worms, moles, and other agencies. But still the bare facts are as have been stated.

But water is more than a mere mechanical worker, and is as much at home in the chemical laboratory as in the simple art of perfecting and extending the minute ramifications of collecting and feeding drains. Water-logged land is in one sense like money in an iron safe in a bank: all its fertility is locked up, but, unlike the money in the safe, its value rapidly depreciates, and will speedily be destroyed. This latter consideration, however, does not affect the present argument. Water, the only known or used seal for our lighting-gas, also seals in the earth's fertility. No matter how full of manure or growing force it may be, neither the cultivator nor the plants can utilise one atom of it till the water-seal is broken or removed. Drainage breaks the seal or opens the lock of the safe, sets free and augments the natural or acquired fertility of the soil, and links that fertility to vegetable life, and transforms it thus into crisp vegetables, beautiful flowers, and luscious fruits.

In these great achievements and transformations, water in motion and water as a solvent bears the most important part. But water does not work alone. For better or worse, water and air are linked together in the economy of the universe. They are cor-

related and intermixed in all possible ways. In the liberation and augmentation of the fertility of our gardens, they were meant to work together almost abreast. Thus harnessed, and mutually supporting each other, their enriching and ameliorating effects are wellnigh inexhaustible. But separated, either or both are comparatively weak.

Now one of the greatest evils of stagnant water in land, as has been already shown, is that it shuts out the air. Hence water at rest and alone in such lands has no power either to change or enrich them. Give the water an exit through drains, and the water becomes at once a real power in transforming bad soil into good, and as the air follows sharp at the heels of the moving water, the entire mass is permeated by their presence. Neither do they enter the earth empty-handed. The water carries with it ammonia; the air, carbonic acid, and other manures; and their presence dissolves, unlocks all the sources of enrichment already existent in the earth. Nor is this all, for the air and water alike are also decomposed, absorbed, and are themselves assimilated into living plants, and transformed into objects of utility or ornament.

The effects of air and water in the earth cannot be exaggerated. In undrained lands nothing is more common than to see manure taken up as fresh after being in the earth a year or more, as when it was first applied. This simply shows that it has done the land no good, however much its qualities may have been deteriorated by its long submersion. But let air, carbonic acid gas, and that busybody oxygen, the great disintegrator of organic matter, and water, have free access to the manure, and then it is decomposed, changed as by the magician's wand, and is henceforth fit to enrich the earth, sustain its fertility, and augment and improve its produce. Possibly the oxygen disappears in the process. But no matter; those drains running deep and clear beneath the cultivated earth not only remove the surplus water, but fetch down as much oxygen and other gases out of the air as are needed.

Nor does the air do all this work for the earth for nothing. The laws of compensation and mutual service run like a golden chain through every field and garden. The air, by thus adding to the fertility of the earth, increases its produce, and that produce is the only means of preserving the purity of the air intact, and its matchless constitution inviolate. Even the temperature of the air is sensibly increased by drainage. Its warming-pan, the earth, has its temperature raised and made more uniform by drainage, and the heat which would otherwise have been wasted in lifting surface water is also husbanded to the amelioration and improvement of the atmosphere.

Drainage Improves the Texture of Soils.—Texture is that peculiar mechanical disposition of soil which separates its particles from one another, and imparts to the best soils the quality that horticulturists prize so highly—that of friability. All undrained soils have a tendency to run together into unfertile and comparatively useless masses of earth. The water, by excluding the air, removes one of the most powerful separating forces. The quality of friability may be added to in various ways, but the first step towards creating and maintaining it in the soil is by drainage. Water in motion, by cutting innumerable hair-like channels, improves the texture of soils, while the air that follows the water everywhere keeps all these open, and makes more by every change of temperature. The friability of soils also favours root-extension, and provides them with abundance of food. They run further and fare better in these than in any other. Soils of good texture also retain and provide more moisture when most needed than any others. The soils that pass the water most freely through them, also lift up most by capillary attraction during severe or protracted droughts; so that unless the porosity of soils is carried to excess, the more friable they are, the more regular and ample the supply of moisture. The subject of texture will be further adverted to in treating on the amelioration of soils, and need not be further dwelt upon here. Suffice it to say that drainage is the most potent means of improving the texture of soils, and without it good friable mould is impossible.

Drainage Deepens Soils.—The process may be slow but certain, and, of course, is greatly facilitated by deep digging and trenching. Still, apart from these, the mere drainage of land will ultimately deepen it almost to the level of the drains. The mere separating and cleaving force of water is, in fact, one of the surest means of slow trenching, or deepening the tilth of land: and the best properties of soil being also the most soluble, of course a modicum of these is carried down by every rain-drop, and by their gradual disposition and distribution the whole of the permeable strata becomes ultimately assimilative to the character of the best surface mould. Thus the mere drainage of land carries forward almost abreast the dual arts of deepening and enrichment of tilths. Where the water and air penetrate, roots will surely follow; and drainage not only opens myriads of fresh root-runs through the soil, but also replenishes them with plant-food for the use and nourishment of plants.

Finally, Perfect Drainage not only Renders the Cultivation of the Soil more Easy and Pleasant, but also more Profitable.—All this is obvious to all readers who have had

any experience in the cultivation of wet land. It is wellnigh impossible to get on to it, and yet more difficult to get off it. And besides, ground operations on wet land do more harm than good. They puddle any texture or friability left in it into a solid inert mass, which the roots can neither run freely through nor grow in to any useful purpose.

The increased productiveness of drained land is a matter of experience patent to everybody. Lands virtually useless before draining, have become among the most fertile and valuable afterwards, and others have had their produce doubled, trebled, increased even fourfold by draining, and the quality of the produce has been as much improved as its quantity increased. Wet meadows that have grown little but the coarser grasses, rushes, and rank semi-aquatic weeds, have yielded capital crops of the finer grasses after drainage, and corn and root crops have been grown into the finest samples where only the most inferior were produced before drainage.

And even greater and more striking improvements have been effected in gardens than in fields. The improvement of soil and local climate following on the heels of drainage has converted not a few of the worst gardens into the very best and most productive. And as the formation, furnishing, and culture of gardens is expensive, and the area is as a rule rather limited for the demands made upon it, it is of the most vital importance that a good lasting foundation should be laid for a full and constant supply of the best produce by the thorough drainage of the soil.

FERNS.

By James Britten, F.L.S.

Gold and Silver Ferns (*Gymnogramma*).—The Gold and Silver Ferns are the most popular and deservedly admired members of a large and variable genus, the members of which are for the most part tropical, two only extending to Europe. The peculiarity to which they owe their name and their striking appearance, consists in the presence of a floury powder on the under, and sometimes also on the upper surface of the fronds. Of the Golden series, perhaps the best known is *G. chrysophylla*, a native of the West Indies, sometimes considered a variety of *G. calomelanos*. The fronds are from one to two feet in length, on firm, dark stems, somewhat erect in habit, and closely tufted: they are oblong-triangular, or somewhat lanceolate in shape, and three times pinnate, with close pinnæ, of which the lowest are the largest. Above, the fronds are of a light pleasant green; below, they are densely covered with a bright golden-yellow powder, through which, when the fronds are mature, the dark sori show themselves. A large number of named varieties are in cultivation. Another Golden Fern is *G. sulphurea*, which is much smaller in all its parts, the fronds being herbaceous in texture, and bright yellow beneath. *G. decomposita* is a native of the Andes; it has thrice-pinnate fronds, the pinnæ being very finely cut; the stems, as well as the under sides of the fronds, are covered with pale yellow mealy powder, which easily rubs off; the upper surface of the fronds is bright green. Of the Silver Ferns, *G. tartarea* is most familiar; it has twice-pinnate fronds a foot to two feet in length, somewhat triangular in outline, the lower pinnæ being the largest; the under side is covered with a powder of snowy whiteness; and as the upper surface is dark green, and the stems and sori are black, a most effective contrast is obtained. This is a native of tropical America, and is nearly allied to *G. calomelanos*, another Silver Fern of robust habit, the fronds of which are more divided, and somewhat less firm in texture. *G. ochracea*, which has pale yellow powder, is a smaller plant, with shorter but more numerous fronds, about a foot high; it is reckoned by some authorities as a variety of *G. tartarea*. The colour of the powder is by no means a constant character; thus, in *G. triangularis*, a green-house species, it varies from deep orange to white. *G. trifoliata* has densely tufted stems, which are scaly in their lower portion, and bipinnate fronds of herbaceous texture; the barren fronds are usually destitute of powder, though the fertile ones are densely clothed with powder of white or yellowish hue. *G. chærophylla* is a pretty little tropical American plant, remarkable for being only of annual duration; it has tufted slender stems three to six inches long, which are brown at the base and green above; the fronds are three to six inches in length, finely divided, and somewhat triangular in shape; they are bright green and almost transparent, and devoid of powder, although nearly covered by the dark lines of sori, which are very freely produced. *G. schizophylla* is one of the most remarkable and handsome of recently introduced ferns; it is a native of Jamaica, where, so far as is at present known, it is restricted to a single locality in the mountains. Judging from the elevation at which it occurs, it might reasonably be expected to succeed in a cool house, but with most people it does better in a stove temperature. The beautiful finely-cut fronds of this species are a pleasing shade of pale green, there being no trace of the mealy powder which forms so conspicuous a feature in most of the other species of the genus. It is readily propagated by spores as well as

by the young plants, which are freely developed in the forks near the extremity of the fronds.

Cultivation.—Most of the Gold and Silver Ferns are easily grown. As a rule, they require more light

Gymnogramma Decomposita.

than most other ferns; indeed, they luxuriate in direct sunlight if the plants have been grown in this way from the first. Specimens which have been accustomed to the subdued light and shading found necessary for so many other ferns, do not, of course, like a sudden change into sunshine, and would for a time show the effects of such treatment. In some parts of tropical America some of the Gold Ferns are amongst the most troublesome weeds when a piece of ground is cleared, and grow with great luxuriance under the vertical rays of a tropical sun. Many of them, in England, other conditions of course being suitable, can scarcely have too much light, and it is important to bear this in mind. For hanging baskets, some of them are amongst the most valuable of ferns, as their bright colours and graceful habit render them so distinct. Syringing should be carefully avoided, as the flour-like powder on the fronds is washed off, and the plants disfigured by the careless administration of water. The mixture in which Gymnogrammas thrive best should be made up of one

part of fibrous peat, one of loam and leaf-mould, and one of silver sand. For large pots a quantity of charcoal broken into pieces about the size of hazel-nuts should be mixed with the soil, in order to more thoroughly insure perfect drainage; where charcoal is not available broken potsherds will be found to answer. Coarsely-ground bones mixed with the soil suit the larger and stronger-growing species well.

Nephrodium Cuspidatum.

Nephrodium.—As understood by the author of the "Synopsis Filicum"—the best standard work from a purely botanical standpoint on ferns ever published—the genus *Nephrodium* embraces nearly three hundred species, and is represented in almost every fern country in the world. All have subglobose sori, which are either dorsal or terminal on the leaflets; the involucre is more or less heart or kidney shaped, and is attached by the sinus. Some of the species vary very considerably in size, texture, cutting, and venation. Our native Male Fern, *Nephrodium Filixmas*, may be taken as a type of a large number having the veins all free, which were formerly, and even now are by some botanists, looked upon as forming a distinct genus, viz., *Lastrea*. In another large group the veins anastomose, that is to say, they re-unite or pass into one another again by means of branches. The only valid characters—those by which the species of this genus may be recognised and distinguished from ferns belonging to other genera, perhaps similar enough in general appearance to deceive a careless observer—are furnished by the fructification, which is shortly described above. *N. amplum*, a native of the West Indies and Central America, is a noble stove species, with a stalk two to three feet long, densely clothed at base with an entangled mass of soft, bright, silky scales and fronds, three feet or more long, with a breadth at base of two feet or more. *N. cicutarium* is a widely distributed species, occurring in a wild state throughout tropical America, the Polynesian and Malayan Islands, Himalaya, Ceylon, Mauritius, and in several countries of tropical Africa; the brownish stalks measure a foot or more in length, and the nearly triangular fronds, with sinuated lanceolate lobes, are from one to two feet long. *N. cuspidatum*, from

North India and Ceylon, has a stalk about a foot long, densely scaly at base, and a frond two or three feet in length by eight or twelve inches in breadth. In *N. decompositum*, which is found in Australia, Van Diemen's Land, and from New Zealand to Tahiti and Fiji, considerable variation occurs both in size and texture, and in the cutting of the frond. This is one of the best of the stronger-growing warm-house ferns of easy cultivation; it has a widely-creeping rhizome, a firm, hairy stalk (scaly only at the base), twelve to eighteen inches long, with fronds one to two feet long by a foot or more in breadth; the cutting in this species is much finer, and the general aspect of the plant is more graceful, than in most of the other species of this rather large genus; several named varieties (wild ones, not forms which have been produced under cultivation) exist in the large fern collection at Kew. *N. decursivo-pinnatum* is of tufted habit, with stalks, clothed throughout with narrow scales, three or four inches long, and fronds a foot or more in length by three or four inches in breadth; it is a native of Japan, China, and Formosa. *N. effusum*, from the West Indian Islands and tropical America, has a shortly-creeping rhizome with polished stalks, slightly scaly below, some two feet long or more, and pale green glossy fronds, three or four feet in length by two feet or more in breadth. *N. giganteum*, a recently introduced species from Ceylon, occurring also in the Malayan and Philippine Islands, has the texture and habit of *N. cicutarium*, but differs altogether in the venation of the fronds. Perhaps the best known and most widely grown of all the Nephrodiums is *N. molle*, which is found in a wild state in all the warmer parts of both hemispheres, and has long been an inmate of British gardens; in this the rather slender stems are tufted, a foot or more in length, with finely hairy fronds, one to two feet long by eight to twelve inches broad. The variety *violascens* has often a conspicuously brightly-coloured purplish rachis. Amongst some of the numerous forms of this popular species which have originated in gardens are the following:—*corymbiferum*, *cristatum*, *densum*, *grandiceps*, *polydactylon*, and *ramosum*, all these being variously crested forms, which the majority of gardeners look upon as preferable, for decorative and exhibition purposes, to the ordinary wild types with plain untasselled fronds. *N. patens* has more or less hairy fronds, two to three feet long by eight to twelve inches broad, and smooth or slightly hairy stalks, a foot or more in length; this is a native of Polynesia, Japan, Zambesi-land, Angola, St. Helena, and is also found from Florida and Texas to Rio de Janeiro and Chili. *N. serra* is a noble species distinguished by its very narrow rigid pinnæ, with deep sharp lobes; the firm glossy stalk is a foot or more long, and the fronds of almost leathery texture, in fully-developed specimens, measure sometimes as much as four feet or more in length by a foot or more in breadth; it is a native of the West Indies, and is one of the most stately of strong-growing warm-house ferns. *N. setigerum* has a rather wide geographical range, being found in Japan, China, from North India to Ceylon and Malaya, and in Polynesia as far east as the Society Isles. Within its range it is a common plant, and varies a good deal in size and hairiness; on this account it has received a number of names, of which that given by Blume, being the oldest, is here adopted. It has a creeping rhizome, with a stem one to twelve feet long, which is either quite smooth or scaly throughout its length; the frond—of which the lowest pinnæ are the largest, often measuring eight to twelve inches long by four to six inches broad—varies from one to three feet in length, and is finely hairy beneath. *N. truncatum* is an elegant sub-arborescent species recently introduced to this country from the Sandwich Islands. It has a short erect caudex, with smooth green stalks, and large, lanceolate, ovate, pale greenish fronds of a firm membranous texture. Besides the Sandwich Islands this species is found throughout Polynesia, in the Malaccas and Australia, and from North India to Ceylon. *N. villosum*, a native of the West Indies, southward to Peru and Chili, is a very fine plant, which is said to attain a height of eighteen feet; it has a tufted habit with stout stalks (densely clothed with spreading scales) two or three feet or more in length, and fronds four to six feet or more in length, with a breadth of about half the length. A great contrast to the last-named species is the handsome little *N. hirtum*, with its tufts of delicate bright green almost triangular fronds, four to six inches long by three to four broad, on very brown densely fibrillose stalks four to eight inches long; this is a native of the West Indies, and has also been found in west tropical Africa.

Cultivation.—Most of the Nephrodiums are strong-growing and easily cultivated ferns, and succeed as well in the green-house as the stove. Good fibrous loam and leaf-mould make the best soil in which to pot them, but where leaf-mould is not to be had the loam will do without admixture—of course, due care must be taken to insure good drainage. Peat, which seems to suit some ferns so well, is altogether unnecessary with the Nephrodiums. Those species with creeping rhizomes may be planted, a number of pieces together, in a pot or pan, and a specimen plant made up for effect almost at once. The tufted ones, however, should be grown singly in pots, as a number planted together would have a stiff and

formal look. All the species, perhaps with a few exceptions, are too strong-growing for basket-work; but even the very large ones do well in pots, and can be kept to almost any size required. Even the huge *N. serra* makes charming little plants for decorative purposes when confined to small pots or pans; and their size depends so much on the amount of root-space, &c., that in small houses and in small establishments a number of the other species, almost equally large under different conditions, can be successfully grown with no more head-room than is required for an equal number of Maidenhairs.

Davallia.—This genus is a very fine and extensive one, with its headquarters in the tropics of the Old World. The fronds vary very considerably in size and in division, few more striking differences in general appearance being presented by a couple of plants in the same genus than the contrast between the tiny *D. parvula*, from Malaya, with fully-developed fronds measuring scarcely so much as an inch in height, and the huge East Indian *D. platyphylla*, which often, under favourable conditions, attains a height of six feet or more. In texture the fronds of some of the species vary very widely, not a few being quite leathery in texture, whilst others are herbaceous. In some species the fronds are pinnate, but in the larger number they are pinnately decompound, very elegantly cut into multitudes of small divisions. The veins are always free throughout the genus, and the rhizome is usually wide-creeping and scaly. The fructification consists of variously shaped cups or cysts, terminating the veins at the margins of the segments. Upwards of a hundred species are known to science, but a considerable number of these have not yet been introduced to cultivation. Scarcely any of them are not thoroughly well worth growing, nearly all being very ornamental and useful plants. Only a selection of those that have found their way to British gardens are mentioned in these notes, and the most distinct and useful have been chosen—in fact, those most worthy of general cultivation.

D. aculeata, a common plant in the West Indian Islands, is by no means so frequently met with in gardens as its merits deserve; it has climbing fronds several feet in length, the slender stalks and the young growths being of a pale claret hue. Though this species makes a fine pot plant, it is seen to greatest advantage when planted out and allowed to scramble at will over rock-work in a stove. *D. alpina* has leathery, triangular, dark shining green fronds not more than six inches in length by an inch or an inch and a half in breadth; it is a native of Mergui, Ledong, Java, Borneo, and the Polynesian Islands. *D. affinis*, from the Neilgherries, Ceylon, Java, the East Himalayas and Polynesia, has a thick rhizome densely clothed with sharp-pointed rusty scales; the strong, erect stipe measures from four to nine inches in length, and the frond itself one to two feet long by six inches to a foot in breadth. *D. brachycarpa*, considered by Mr. Baker to be a variety of the Polynesian *D. gibberosa*, is a recent introduction, with bold and yet elegant fronds of a pleasing light green colour, gracefully reflexed on all sides. *D. bullata* has a stout creeping rhizome, densely clothed with light brown or whitish fibrillose scales; the strong erect stipe is three or four inches long, and the frond eight to twelve inches long by four to eight inches broad. This species, which is known in some gardens as the Squirrel's-foot Fern, is not unlike the more widely-grown Hare's-foot, *D. Canariensis*, but it is smaller in size, the fronds are thinner in texture, and the scales of the rhizome are very different. It is a native of Hindostan (ascending in the north of that country to elevations of 3,000 or 4,000 feet), Japan, Java, and the Malayan Peninsula.

D. Canariensis, the Hare's-foot Fern, perhaps the best known of all the genus, is almost too well known to need any description. It is additionally interesting as being the only Davallia which is represented in a wild state in Europe. Its native countries are Spain, Portugal, North Africa, the Canary Islands, and Madeira. As might be expected from its geographical distribution, this species requires less heat than almost any other of its allies, and succeeds thoroughly in an ordinary green-house. *D. chærophylla*, from the North of India (where in the Himalayas it ascends to an elevation of 9,000 or 10,000 feet above sea-level), Cashmere, the Neilgherries, Ceylon, and the Malayan Archipelago, has a wide-creeping rhizome, clothed with broad obtuse adpressed scales; the naked stipe measures from four to six inches in length, and the thinly herbaceous, rather flaccid frond from nine to fifteen inches in length by from four to eight inches broad. The Philippine Islands *D. ciliata* has the rhizome covered with soft brown hairs; the firm, erect, hairy stipe is about three or four inches long, and the lanceolate frond measures a foot to a foot and a half in length by about six or nine inches in width.

D. divaricata has a stout creeping rhizome, clothed with linear ferruginous scales, a firm erect stipe, six inches to one foot long, and a tripinnatifid leathery frond, two to three feet in length; it is a native of Khasya and Mishmee, North India, the Malayan Archipelago, Hong Kong, and Java. *D. elegans* is a beautiful species, one of the most charming of all the Davallias. It has a stout creeping rhizome, densely clothed with woolly fibres; the firm erect stipe is from four to eight inches in length; and the

deltoid, tripinnatifid, dark, glossy green, leathery frond measures from one to two feet in length, by nine to fifteen inches in breadth. There are a number of well-marked varieties of this fine species occurring in a state of nature, and one, at least, of garden origin. Under the former category must come *elata* and *dissecta*, and under the latter *polydactyla*, in which, instead of the pinnæ and pinnules terminating in a narrow point, they dilate and subdivide, and thus form a strikingly handsome crested form. *D. elegans* has a remarkably wide geographical distribution, being found in Ceylon, the Malayan Peninsula, China, Java, Borneo, the Polynesian Islands, tropical Australia, Madagascar, Angola, Fernando Po, and Johanna Island. The species with the most finely divided fronds of all the true Davallias—*i.e.*, the species which by universal consent are always placed under *Davallia*, and not under any of the sub-genera which by some authorities are looked upon as constituting distinct genera (*microlepia*, *stenoloma*, &c.)—is *D. Fijiensis*, a very beautiful fern that has been introduced into this country within a very recent period. It has dark green, very elegant, somewhat leathery fronds, which when cut keep fresh for a considerable time. As implied by the name, it is a native of Fiji, where it is very common; two well-marked varieties, from a garden point of view, are already to be met with in nurseries, var. *plumosa* and var. *major*. In *D. heterophylla*, from the Malayan Archipelago and the Polynesian Islands, the wide-creeping rhizome is scaly, and the short-stalked, smooth, leathery fronds are from three to six inches long by an inch in breadth. This species is remarkable by reason of the barren fronds being entire, and the narrower fertile ones more or less deeply cut—the contrast between the two being so striking as to make a casual observer believe two distinct species are represented.

D. hirta is a huge species with stout stipes from one to two feet long, and triangular fronds three to four feet long by one to two feet broad. It is a native of the North of India, Ceylon, the Malayan and Polynesian Islands. The recently introduced *D. Mariesi* is a dwarf-growing, very graceful species, and an excellent subject for small baskets, or for covering small rustic ornamental portions of the rockery. In Japan various designs are made with curved pieces of wood, &c.; these are covered with moss, and the slender rhizomes of *D. Mariesi* are then attached to the surface by means of wire. To produce a profusion of fine green fronds, only an abundance of moisture is needed, and if this is granted, the designs—crowns, vases, wreaths, &c.—may be suspended in any warm-house near the glass. After being well established these succeed for some time in an ordinary dwelling-room. During the past year a number of different fern designs have been imported from Japan, some of them a good deal more curious than artistic. A crested form of *D. Mariesi* is also in cultivation. One of the finest and most popular of exhibition ferns is *D. Mooreana*, from Borneo, a rapid grower, and one which readily develops its beautifully arched, delightfully pale green fronds even in small pots. Full-sized fronds grow to about three or four feet in length by from eighteen to thirty inches in breadth.

The New Zealand *D. Novæ Zelandiæ*, with its creeping rhizome clothed with filiform scales, has finely-cut deltoid tripinnate fronds, of somewhat leathery texture, twelve to eighteen inches long by four to eight inches broad, the firm erect stipe being from four to eight inches long. *D. parvula*, from Singapore and Borneo, is an exquisite little plant, only an inch or two in height; in its native habitats it affects the trunks of trees and similar situations, which it clothes with a carpet of its tiny dark green fronds. In order to grow this well, a shallow pan with perfect drainage is best, the very slender rhizomes clothed with bright brown scales being allowed to creep over the raised surface. For cool conservatory decoration, especially when planted out, or otherwise allowed plenty of root-room, one of the most striking of ferns is *D. platyphylla*, a common species in Hindostan; this has stout creeping, scaly rhizomes, and stout, firm, erect blackish stipes, two or three feet long, and tripinnatifid somewhat leathery sea-green fronds, three to four feet long. Another excellent green-house species is the New South Wales *D. pyxidata*, which in habit and texture comes somewhat near *D. Canariensis*, but is rather more finely cut and veined. *D. strigosa*, although doing well enough in a warm-house, is thoroughly at home, especially if planted out, in the cool conservatory; it has a stout creeping, pubescent rhizome, the strong erect stem being six to twelve inches long (both it and the rachis being hairy throughout), and lanceolate bipinnatifid pale green fronds, one to three feet long by six to twelve inches broad. This species has a somewhat wide geographical distribution, as it occurs in a wild state in North India, in Ceylon, Japan, the Malayan Peninsula and Islands, the South-east of China, and in the Sandwich and Fiji Islands. Both for exhibition as well as for general decorative purposes, *D. tenuifolia* is very useful; the lively green fronds, from twelve to eighteen inches long by six to nine inches broad, are borne on strong, erect, dark brown, polished stipes, six to twelve inches in length. This species is widely distributed throughout the tropics of the Old World. *D. Tyermanni*, supposed to be a native of western tropical Africa, is one of the most distinct and useful of green-house ferns; the wide-

creeping slender rhizomes are densely clothed with adpressed silvery scales, which are particularly conspicuous when the plant is grown upon a tree-fern stem. The combination of colour formed by the silvery scales of the rhizome, the reddish stipe, and the dark green fronds is very pleasing. This species is a neat grower of moderate size, the fronds not exceeding eight inches or a foot in height.

Davallia Fijiensis.

Cultivation.—All the Davallias are especially impatient of stagnant moisture, and thrive best in a thoroughly drained compost; almost any soil will suit many of them, if the drainage requirements—the most essential of all conditions—are attended to. Either pure fibrous peat, peat and leaf-mould, or the latter with an admixture of silver sand or charcoal, will do. Of course the larger, stronger growers are not so particular, and succeed well in pots; the smaller ones, and more especially those with slender rhizomes, should either be grown in baskets or as recommended below. A good plan is to have a shallow pan of the required size, place an inverted pot in the centre (larger than the depth of the pan), and after putting in drainage, fill up and round the pot with pieces of peat or a mixture of peat and sphagnum, fastening the whole together into a rounded cone by means of wire. The creeping rhizomes should then be placed on the surface, attaching them by pegs or small pieces of wire. With a plentiful supply of water — and in a properly prepared pan there is scarcely any danger of over-watering, in the growing season, at any rate—growth soon commences, and the rhizomes soon form a network over the entire surface. During winter water should be more sparingly administered, care, however, being taken never to let the pots or pans become dry. A fairly light place, if somewhat near the glass so much the better, is appreciated by most of the Davallias.

THE FLOWER GARDEN.

By William Wildsmith.

THE PROPAGATION AND WINTERING OF SUMMER BEDDING PLANTS.

IF the various methods of propagation needed for the different sections of bedding plants, and the best time of year to propagate a given species, be well understood, there will rarely be any difficulty about getting a sufficiency of stock—of course, always supposing that appliances, cuttings, and labour are ample. To the saving of the latter, and also to avoid occupying unnecessarily valuable room in houses and pits during the winter, a rough estimate of the numbers of each plant likely to be wanted should be made at the commencement of the propagating season, which period is the beginning of August. We will take first the kinds that are best "struck in quantity" in the autumn. By this is meant kinds that give less trouble than were their propagation deferred till spring.

Pelargoniums.—First on the list are *Pelargoniums*, of all sections, as they can at that time be struck readily on a sunny border in the open air, the only preparation necessary for reception of the cuttings being that the soil be light, with plenty of vegetable or leaf-mould mixed with it, that the plants may lift with plenty of fibre when ready for potting or boxing. The cuttings should be the *shortest*-jointed, or, in other words, the sturdiest that can be spared from the beds, and not less than five inches long for the dwarf growers, while they may range as long as nine inches for the more vigorous zonales. They should be cut cleanly to a joint, for if *hacked*, or the stems bruised, the probabilities are that they will damp off. Insert them with a pointed stick about three inches apart, taking care to well "firm" them in the soil. If the weather be dry a good soaking of water should be given as soon as the cuttings are put in, but no other watering will be necessary unless the weather be exceptionally hot and dry.

Another mode is to put the cuttings in pots, pans, or boxes direct, a plan that in wet seasons, or wet districts, is to be commended, as then they can be afforded shelter from heavy rains under lights, and yet have exposure to *full sunshine* at every chance, an element essential to a healthy growth and safe wintering. If the cuttings are intended to be struck in this latter fashion, greater care is needed in preparing the soil, as it must be remembered that the plants have not only to be struck in it, but *wintered*; hence, whilst the constituents for striking must be present, there must also be food for the plants, and that too without having frequent recurrence to the water-pot, during the dullest weeks of winter. The following compost, if made moderately firm in the boxes, insures these conditions:—One part sand, one part leaf-mould, and two parts of ordinary potting loam. Also sift through a half-inch sieve, and place a thin layer of the siftings of fibre over the crocks; the plants lay hold of this fibre with such tenacity, that when they have to be potted off they move with such a mass of roots that the check to them is all but *nil*.

Plants struck out of doors require to be potted up by the third week in September, but should continue to have all the exposure possible till the advent of frost renders it unsafe to leave them out any longer. A watery, spindly growth at the commencement will neither winter successfully, nor ever make satisfactory progress afterwards; hence the injunctions to give exposure, which conduces to sturdiness, from the beginning. It is necessary that plants struck after either mode should be well cared for in the matter of keeping them clear of decaying leaves, the flowers picked off, and the points pinched out of any that manifest a tendency to run up without branching at bottom.

As to *wintering* the plants, of course the best place is a light airy house where a minimum temperature of 40° in the severest weather can be maintained; more often, however, rough structures have to do duty for good houses, and therefore it is in reference to these that a remark or two is needed. Damp is more fatal to the plants than cold—at least, any short of actual frost—consequently drips from the sashes, splashing about of water, or an over-dose of it to the plants being preventible, their avoidance should be insisted on. When watering is needed, choose a drying day when the lights can be opened, and fire applied to expel damp, and only a sufficiency of fire to keep out frost and keep the air dry should ever be used. Given these conditions, the plants will thrive well, needing increased space both at root and top by the middle of March. At that time all the rarer, such as tricolour and variegated kinds generally, should, if space admits of it, be potted singly into sixty-size (three-inch) pots, but others may be planted out in cold pits, where the lights are movable, that the plants may, as it were, be turned outside at all favourable times. Till the plants are re-established in the new soil, but only till that has taken place, is a little warmth and a closer atmosphere necessary.

If, as sometimes is the case, certain kinds of cuttings of Pelargoniums cannot be had in sufficient quantity in the autumn, recourse may be had to spring propagation, which is as follows:—The stock plants should be placed in warmth by the end of January, and as soon as they have well started into growth, so far that cuttings three or four inches long

can be had, they may be taken off and be put singly into three-inch pots, a mode of propagation that saves any further hindrance as to potting, &c., as they can be transferred from these pots direct to the beds. Place the cuttings on shelves, exposed to full light, and a temperature of from 60° to 65°, then, with careful attention in regard to watering, they will strike just as successfully as in autumn. As already remarked, further potting is really not essential, but should extra good plants be desired it ought to be done. Space for the plants, and time for the operation, must decide whether this can be done or not.

Violas.—Several varieties of these are scarcely second to Pelargoniums for summer bedding, and all are best propagated in autumn, and from cuttings only; the plants obtained by division never appear to grow so compactly or so luxuriantly as those obtained from the young side-shoots that spring from the base of the plants, and which about the middle of September are to be had in great abundance. They should be split off with the fingers, and will generally be found to have a few rootlets attached. These, if long, it is necessary to shorten with a sharp knife, as the cuttings ought not to exceed three inches in length. In the south of the kingdom they strike and winter successfully on sheltered borders without protection; but the safest and more general plan is to strike them under hand-lights, or in cold frames, which may be kept rather close till they get a firm grip of the soil; then they must have all the air possible. A mixture of loam and leaf-soil—*no sand*—and the cuttings inserted firmly, will end in a good strike. The reason why we say *no sand* is, that as the plants have to stand in the cutting-beds till transplanted to their permanent quarters, they need a soil that will maintain them in vigour till that time, and sand has none of these properties. If the beds or borders that they are intended to occupy be vacant, transplanting may begin early in April, taking care to move them with balls of earth attached; this the presence of leaf-mould in the soil renders an easy matter. Deep rich soil is indispensable to continuous flowering and freedom from the parasite, mildew, to which Violas are peculiarly liable.

The foregoing treatment is in every particular applicable to the propagation *by cuttings* of *Pansies*, *Antirrhinums*, *Pentstemons*, and *Phloxes*, all of them so excellent for mixed summer bedding or for hardy flower borders:—

Seedlings.—Though favourite varieties can only be perpetuated with certainty by cuttings, the strains have now been brought to such perfection, that but a small percentage of inferior kinds is now possible from seeds, which to those with limited accommodation as to hand-lights, or other shelter, is the best way to get up a stock.

The seeds should be sown in March either in pans or in hand-lights, the soil to be light sandy loam, with the merest sprinkle of a covering; water with a fine-rose pot, and keep close till germination has taken place; then air freely, and prick off the seedlings as soon as large enough to handle. Again keep close, for a week or so, then gradually inure them to the open air, transplanting them as soon as large enough to their permanent positions, when they will produce abundance of flowers throughout the autumn.

Calceolarias.—Of late years the culture of the shrubby section of these has declined, the reason given being their uncertainty of continuous flowering, more especially in hot seasons, and their liability to die most mysteriously from some affection that attacks them at the ground-line. We have proved that both these evils are preventible by high culture, and therefore advise their continuance for bedding-out purposes.

It is well known that if any plant is predisposed to disease, nothing more readily aids its spread than lack of vigour, hence high culture should begin at the very commencement, viz., with the cuttings. These should be taken off early in October, those springing from near the base of the plants, and that have not been smothered in foliage to render them weakly, or what gardeners term "drawn." Cut them with a sharp knife, and of such a length as will admit of two joints being inserted in the soil, leaving about three above. They are impatient of artificial heat at all stages of growth, and therefore a cold pit, in the strictest sense of that term, is the best possible structure in which to strike and winter them. The soil, about six inches in thickness, should be sandy loam and peat, or leaf-soil, in equal proportions, which should be placed over a layer of rubble—siftings of the same material—and be well pressed down; then the cuttings to be dibbled in three inches apart, this distance admitting of their standing in the cutting-pit without getting lanky, till the spring, when they can be transplanted to any sheltered nook, an excellent place being at the foot of the fruit-walls, where they can share in the protection afforded by the trees. A good watering is necessary as soon as the cuttings are put in, to well settle the soil about them, this generally being all the water needed till they are struck, which takes from six to eight weeks to accomplish, all of which time the lights should be kept closed, and a slight shade applied whenever the sun is powerful. At the end of that period air may be given freely, and such

protection in severe weather, by covering with mats, straw, hurdles, litter, or bracken, as will insure the atmosphere of the pit not receding lower than 30°. The flower-buds and points of the shoots should be kept off to induce a branching habit of growth, and any moss, or fungus, forming *on the soil*, should be instantly removed. Pots, boxes, or pans so soon get full of roots (a check consequently ensuing) that they ought never to be used for Calceolaria propagation; indeed, at every stage *pot culture* for these *is undesirable and unnecessary*. The soil in which they are to be planted out in summer cannot well be too deep or too rich, and if it answers to this description, its natural properties are immaterial.

Gnaphalium lanatum, and Variegated Thymes.—Both of these are invaluable ground-work plants for summer bedding, and being amenable to the selfsame treatment in regard to propagation, we class them together. Cuttings of a partially hard nature—neither succulent nor woody, but what is termed, in gardening phrascology, *half-ripened*—if taken off about the end of September, strike freely under cold-frame treatment, and in any description of light soil.

The cuttings may be inserted—Gnaphalium at three inches, and Thymes at two inches apart, and in bright weather must be kept shaded till the roots are emitted, after which they may be fully exposed in all weathers, except when frosty. Even this will not injure the Thymes, but Gnaphalium will not stand more than two degrees, and therefore requires mat or straw protection in severe weather. The points of the shoots should be kept pinched out of both to keep them as bushy as possible, and as neither is injured by overcrowding in the cutting-frames, the plants may remain there till wanted for their final quarters. Both are good subjects for edgings and ground-works. The Gnaphalium requires pegging down, and to have the flowers and long shoots pinched off, and the Thymes may be planted sufficiently thick to admit of their being clipped to induce a bushy growth.

Echeverias.—These plants, which are so useful for edgings, particularly in carpet-bedding designs, are also most expeditiously increased at the autumn season by offsets from the old plants, and the larger such offsets are the better. The varieties *Secunda glauca* and *retusa* are comparatively hardy, and can be safely wintered on sloping banks of soil raised against the walls of forcing-houses, or other sheltered spots. *Wet* is more fatal to them than frost, hence the slope to throw off the rain. Mats tacked to the wall, as a covering in severe weather, are really all the attention they need from the time of inserting the offsets till the plants are needed for the beds in May.

Sedum acre elegans and *Spergula prolifera aurea* are barely hardy; at any rate, they will not stand satisfactorily without *autumnal division*, which is the best time and way to propagate them Pieces taken carefully out of the beds, so as not to mar their appearance, split up into the smallest particles, and pricked out closely together on a dry border facing the south, quickly make nice plants and winter safely except in the severest winters. The winter treatment necessary is simply to well press them into the ground after each frost, which, occurring before they get deeply rooted, heaves them out of the ground. All other kinds of hardy carpeting plants make much the nicest plants for spring transplanting when time can be spared for dividing them in the same way in the autumn. The plants so obtained fill out their space in one-half the time required by those which are split up from the old plants at planting-out time in May.

The following are kinds that must be propagated in *autumn*, but only in sufficient quantity to produce abundance of cuttings for spring propagation, thus saving both labour in watering and other attention, as well as the room they would occupy throughout the winter.

Alternantheras.—It is necessary to be very particular in selecting cuttings of these to avoid *flower* or *seeding* shoots, which though they strike never make good plants. Suckers, which spring up from the collar of the plants, should be chosen, and require only a clean pinch with the finger and thumb to make them ready for the cutting-pots, five-inch size, each of which will hold about a score of cuttings. A dozen of these pots will produce cuttings sufficient to make as many thousands, by the mode of propagation to be named, for the spring time. Soil of a peaty nature, with a goodly addition of sand, is what they relish to strike and grow in. The cuttings should be taken off as early in September as practicable, inserted as above, and the pots plunged in a gentle bottom heat, such as that which is given off by three or four feet thickness of oak-leaves. No top heat is necessary, but shade is required during bright sunshine. Under such conditions they will be well rooted in about three weeks, and may then be transferred to shelves in cool vineries, peach-houses, or even cold frames, till cold weather sets in, when a warm dry temperature, averaging 60°, is requisite to keep them in vigorous condition till the advent of longer days in spring. In March they should be given the warmest moist position available, and growth will quickly follow. A hot-bed of leaves and litter should then be made up, and on it place six inches of rough leaf-soil, press down with a spade, then four inches of fine soil (loam and peat is best, but almost any kind of light soil will do), leave

it a couple of days for the soil to get warm, then dibble in the cuttings two and a half inches apart, water with tepid water, shade and keep close. Not one per cent. will fail to strike, and what is more, the plants may remain there till required for planting out. In this way we strike very many thousands each year, the frames that have done duty for the first batches being lifted off and used for others. Makeshift protectors, with rails and mats, are improvised for the protection of the plants from which the frames are thus taken. To bring up the plants sturdily, any disposition that they manifest to grow lanky should be checked by pinching out the points.

Abutilons, *Agathæa cœlestis* (Blue Marguerite), *Ageratums*, *Alyssum variegatum*, *Coleus Verschaffeltii*, *Fuchsias*, *Gazanias*, *Heliotropes*, *Iresine Lindenii*, *Petunias*, *Pyrethrum* (French Marguerites), and *Tropæolums* all need similar structures and *bottom heat* for *autumn* striking to those named for Alternantheras, and, with the exception of Coleus and Iresine, they will all winter in any light position where the temperature does not sink below 40°. Coleus and Iresine require the warmest place at command.

Spring propagation of these follows much on the same lines as Alternantheras, except that they are not so accommodating as regards space, and room must be found in the houses for pots, pans, or boxes till the season is advanced sufficiently for them to be placed in turf pits, or cold frames, preparatory to final planting out. A capital striking-pit for the *spring season* for all these kinds of plants can be made in melon and cucumber-houses, the front portion of the beds being partitioned off either with turves, oak slabs, or bricks; a *sunken* cutting-bed can thus be formed, and be covered with glass resting on the front wall and the wall of the partition. Here the cuttings will strike in an incredibly short time, and, if not left longer than to get well rooted, the shade from the over-growing melons or cucumbers will have no detrimental effect. Abutilons and Marguerites should be potted off singly, but the others will grow well for a long time if planted several in a pot. Warmth and moisture are requisite till new roots are being made in the fresh soil; they may then safely be moved to cooler places, to make room for others that are to be potted.

Verbenas, Mesembryanthemums, and Lobelias, of the Erinus section, also make the finest growth from *spring*-propagated plants, but stock-plants of each must be prepared early in September. Verbenas, like Calceolarias, are often unjustly disparaged on the ground of their liability to fail, which from personal practice we can answer is preventible. Good cuttings, free of flower-buds and insects, and taken off the plants at the outer edges of the beds, which are always the most vigorous, should be inserted in pans, not closer together than two and a half inches; the soil to be sandy loam, and moderately well pressed down. Well soak them, and place in a cold frame on a bed of ashes, to keep worms and slugs at bay. The lights must be kept closely shut during the day, and shaded with double mats when there is any sunshine, the aim being to keep them as *cool as possible*, as in this way they strike root without making any top growth whatever—a point of great importance with plants which it is desired should develop a short-jointed sturdy growth from the very foundation. After the first week the heavy watering necessary to insure the soil being closely sealed round the cuttings will have somewhat dried up. Then should commence light syringings, early in the morning, before shade is applied, and from this time also the lights may be tilted up an inch or so at night, to be closed the following morning after the syringing has been done. In a month they will be nicely rooted. They may then be placed in any shady place out of doors, and be moved to a cold pit for the winter as soon as frost renders it unsafe to leave them out any longer. The winter treatment is to keep cool and airy, and keep a sharp look-out for mildew and fly, neither of which is very troublesome when the plants have had due care as to striking, and are growing in rich soil that is never allowed to get really dry. Spring propagation should proceed in the same way as that given for Alternantheras, only less bottom heat is needed, and the frames may be removed, and temporary protection be given, as soon as ever the plants are established in the soil.

Lobelias do not come true from seed, and a few stock-pots take up so little space during the winter, that cuttings only of good kinds should be grown. All the remarks made above as to the propagation of Verbenas apply to these, except that a slight bottom heat is requisite till they are struck: after that the treatment is exactly the same. Spring-struck cuttings as soon as well rooted may be transplanted into cold frames, leaf-mould being the principal compost used, that they may lift with good balls when they are to be finally planted out.

Mesembryanthemum cordifolium variegatum is one of the most elegant and popular of summer bedding plants, and withal is very easy to manage. Autumn-struck plants never grow satisfactorily, as they always manifest such a disposition to flower and seed—a failing no doubt due to their getting root-bound during the winter. It is, therefore, preventible. We have proved that spring cuttings most quickly fill out their space, and do not seed till quite the end of summer, and this being so, it is not worth while to propagate in autumn more than what are required

for stock. For this purpose, square pans a foot square are best. These hold about three dozen cuttings, and a half a dozen pans will produce an immense quantity of cuttings in spring. Like most other succulent plants, this grows best in an open and freely-drained soil, and the drainage of the pans should therefore be well done, and if with the soil—light loam and sand—a small proportion of finely-broken potsherds and charcoal be mixed, there will be less liability of the plants suffering from an overdose of water during the winter. As soon as the cuttings are put in, a good watering will be necessary, but no more should be given till the soil seems really dry, or is observed to be cracking from the sides of the pans. They never fail to strike if placed on a shelf over hot-water pipes, no shading or propagating-glass being needed. They will winter satisfactorily in any light position and in a greenhouse temperature. In February they must be put into heat, and cuttings may be taken as soon as to be had of a couple of inches in length. At this season they strike most readily under glasses in bottom heat, in the same manner as most other soft-wooded plants, and as soon as struck must be transplanted into boxes or pans, and kept in heat till they have recovered from the check of removal; afterwards cool houses and pits, coupled with careful watering, will keep them in slow but vigorous growth.

Roots and Tubers.—Single varieties of Dahlias have lately become so popular, that they must have the first place on the list under this heading. The mania for them still spreads, and the consequent evil is already apparent, viz., that of sending out innumerable varieties which are different only *in name*. It would be well if growers would content themselves with half a dozen kinds, and grow that number *well* in groups and masses for distant effect, or alternate, as to colour, in mixed flower borders. They are most readily raised from seeds, which ought to be sown in heat in February, then good plants may be had for planting out in June, and will be in full flower by the beginning of August. Sow in pans of light loam, covering the seeds thinly with sand, water, and place them in the propagating-pit. As soon as germination takes place the pans should be shifted nearer the glass, say a shelf in a plant-stove, pine-pit, or a vinery that is being forced; here they may remain, being well supplied with water, till the plants are large enough to be potted singly into thumb-pots, to be grown on as rapidly as is possible so long as the growth continues of a robust description. Five-inch pots will be none too large for the second potting, which will be needed at the end of April, or early in May. *Named kinds* can only be had true from cuttings. Stock-roots placed in a bottom heat of 65° in February or March will afford cuttings within three weeks. Sever them from the old root with a bit of it adhering, and put them in thumb-pots, plunge in bottom heat, keep moist and shade. The cuttings should never be allowed to flag, or the chances are that they will fail to strike, or if this does not happen they will be double the time in striking which those are that do not flag. As soon as rooted, treat them exactly the same as advised for seedlings. The double or show kinds can only be had from cuttings, and are propagated in the same way.

Cannas.—These are about the most stately of foliage bedders, and their culture and propagation being of the simplest description, admits of no excuse for their not being used in quantity. Old roots *can* be wintered in any out-of-the-way shed or cellar, light or dark is quite immaterial, so long as there is freedom from frost. If lifted with soil adhering, none other is needed; but if bare, they may be roughly heeled in, packed closely together in any kind of soil, sawdust, or cocoa fibre; and in this form they may remain till the end of April, except such roots as are needed for increase of stock; these may be brought out and parted into single crowns, and be potted in such sized pots as the size of crown demands. Till new roots have begun to work in the fresh soil there will be little top growth; therefore, the plants may stand in any out-of-the-way place, under stages or trellises, without injury accruing to them; but once top growth has started, light and gentle warmth must be afforded, else the growth will be of an attenuated nature, and get crippled as soon as turned outside. Seeds sown in January in strong bottom heat make good plants by bedding-out time; but they will not compare in vigour with the strong crowns that are taken from old stools five or six weeks later.

Salvia patens, *Verbena venosa*, *Perennial Lobelias*, and *Marvel of Peru*, are all of them indispensable in summer bedding; indeed they may be called everybody's plants, as they are easy to grow and increase, and above all to winter, which they do safely in any place from which frost is excluded. The roots of the Salvia, and Marvel of Peru, only require to be surrounded with any kind of rough soil, to prevent the shrinking of the tubers. The roots may be divided for increase of stock any time during the month of March; boxes are the most convenient for planting them in, and with cold-frame treatment afterwards, they will make good plants by bedding-out time. *Verbena venosa* generally winters well in the open ground, but the flowers do not come so fine, or the growth so regular and robust, as when the roots are lifted annually, and covered thickly with dry soil during the winter, and are propagated afresh in April by cutting up the most fleshy parts

of the roots into lengths of about three inches, and planting them in boxes of light soil, and starting them into growth by giving them frame protection for a month or so afterwards. Perennial Lobelias, being all but hardy, can also be wintered without much trouble. We place them thickly together on the orchard-house borders, and split up the roots in spring to any size or number needed, planting them in boxes in the same way as named above. Seeds sown early in spring, in gentle heat, make moderate-sized plants by the end of summer, but produce little flower that season, therefore preference should be given to propagation by division.

Coloured Foliage Bedders from Seeds.—*Amaranthus melancholicus ruber*, once so popular, has of late been somewhat neglected in favour of Alternantheras, many of which are of the same bright colour, viz., a purplish crimson. The plant, however, does not merit such treatment, for its uses and effectiveness are, to say the least, equal to Alternantheras, and stock of it is just as quickly increased, and withal there is no *wintering* or house-room required at that season. To get good plants by the end of May, the seeds should be sown in March in pans of light soil, the seeds to be covered very lightly indeed, and be kept shaded till germination takes place, with a view of preventing watering, which, if not done very carefully, washes the seeds to the sides of the pans. Prick out the seedlings as soon as they are large enough to handle into other pans of light rich soil, and keep in heat till the roots have got a good hold of the new soil; and from this stage they will grow well in a cooler temperature. They ought not to be planted out till the first week in June, and like a rich soil and a sunny aspect.

Amaranthus caudatus (Love Lies Bleeding).—This is as different to the first-named as it is possible for two plants to be that belong to the same genus; the first rarely exceeds a foot in height, but this we have seen five feet high, with long tail-like racemes of flower—some four feet long. It is the perfection of a plant for a back line to a ribbon border, or as a marginal line round a bed of *Ricinus* (Castor Oil Plants). In good soils the plants should not be nearer together than two feet, or eighteen inches apart in ordinary garden soil, and staking is required as soon as the plants attain a foot or so in height; the weight of the racemes renders such supports imperative. If sown in pans about the middle of April and placed in a temperature of 45°, the plants will be ready for planting out at the end of May. It ought not to be sown earlier than April, otherwise, being a rapid grower, the plants are apt to get stunted before it is safe to plant them out.

Perilla Nankinensis and *P. laciniatus* are two purplish-bronze-leaved plants of very easy culture, as the seedlings may be raised under hand-lights in the open air, and in the north of the kingdom. Where Coleus and Iresine do not flourish they are excellent substitutes for them. Sow in March, prick out the plants when a couple of inches high, and cover with hand-glasses till established, then gradually inure them to full exposure, and plant out at the middle of May.

Cineraria maritima, *C. acanthifolia*, *Centaurea ragusina*, *C. Clementii*, *C. gymnocarpa*, are all of them silvery-grey foliage plants, and are most valuable for association with pink Pelargoniums, purple Verbenas, or blue Lobelias. Sow in pans in February, and place in heat till the seeds are well through the soil, then on shelves in any house or pit having a temperature of 55° or 60°. The seedlings to be transplanted into other pans when an inch high; keep close till new growth is perceptible, then give them a more airy position. Before the roots get matted together, they should be either potted off separately, or else be planted in frames, or boxes, and in soil containing a large percentage of leaf-mould, else it will be difficult to move them to their final quarters with balls of earth adhering, and this is essential to the plants starting into kindly growth.

GREEN-HOUSE PLANTS.

By William Hugh Gower.

Aloe.—This is a genus of old-fashioned succulent plants. Some of them are very curious, and many are extremely handsome and highly ornamental, either in or out of flower. They are mostly natives of South Africa, although some species are to be found in all warm countries. The drug called "bitter aloes," used as a purgative and tonic, is familiar to the school-boy's ears as "household words," and is the produce of some few species of this genus, which are largely grown in the West Indies, the Cape of Good Hope, and also in Zocotria, a little island situated near the mouth of the Red Sea. Their medicinal virtues, however, will not interest our reader so much as their ornamental qualifications. Aloes are plants of the easiest cultivation; indeed, they may frequently be seen growing and flowering with more vigour in a cottager's window than in the best green-house and under the care of skilled gardeners. They should be potted in sandy loam, with a little old mortar rubbish added. The pots used should be small ones, drained well; and during the summer months they enjoy an abundant supply of water; during winter little or none should be given, and the temperature should not fall lower than 45° or 50°.

Cultivators must not, however, fall into a hard-and-fast line respecting the winter treatment of these plants, for although but very little water is necessary, the plants must not be dried to such an extent that the leaves show signs of shrivelling, or they will assuredly deteriorate in beauty. In some instances these plants after a few years will become too tall for those having a small house in which to grow them; this, however, need not cause any uneasiness, as they are easily brought into size and shape. The spring is the best time to operate upon them, and all that it is necessary to do is to cut them down to the required height, place them in a pot of dry soil, and there let them stand until fresh roots are developed from the base of the stem, which will be in a short time; when this takes place, give a small quantity of water from time to time until the pot is well filled with roots, when the supply can be increased in quantity.

ALOE VARIEGATA.

Aloes should be kept in small pots, and seldom require re-potting; one of the greatest mistakes made with these plants is in giving them too much soil and pots of too great dimensions. Although the various members of this genus succeed best when fully exposed to sun and light, they do not thrive so well when stood in the open air, for under these circumstances in our variable climate they are apt at times to get an over-abundant supply of water, and the leaves often become brown, which is a great disfigurement. It is this, more than any inability to withstand the temperature, which makes them more suitable for in-door life.

The varieties of Aloes are almost endless. The following are a few of the most ornamental kinds, and well deserve the attention of all plant-growers.

A. Abyssinica.—A large and massive species; leaves thick and fleshy, furnished at the margins with a few blunt spines, heavy green in colour; native of Abyssinia.

A. Africana.—This plant has a cylindrical stem, and attains a height of eight feet or more; leaves long and narrow, tipped with red, spiny at the edges: it produces a handsome spike of red flowers. Cape of Good Hope.

A. arborescens is a plant which, under favourable circumstances, attains a height of from ten to fifteen feet, producing many lateral shoots, and forming a very handsome specimen; leaves long, sharply tapering from the base, glaucous, with bright green spiny margin; flowers deep red, very showy. Cape of Good Hope.

A. depressa.—An elegant small-growing kind: leaves glaucous, and densely armed at the edges with spines; spike long; flowers red, tipped with green.

A. ferox.—A tall grower, with glaucous leaves, which are profusely clothed with spines; flowers yellow. Cape of Good Hope.

A. humilis.—There are several varieties of this plant; it is a small grower, with dark green glaucous leaves, spiny all over; spike large; flowers numerous, bold red, tipped with green.

A. maculata. — Leaves long and narrow, bright green, irregularly blotched with white, very handsome; flowers not conspicuous.

A. mitræformis.—A bold growing kind of medium height: leaves broad, furnished at the edges and upon the back of midrib with stout spines; spike branched; flowers large and numerous, bright scarlet.

A. mitræformis brevifolia.—A beautiful form: leaves short and broad, glaucous with white spots; edges broadly margined with white, and spiny; flowers in a dense corymb, large, bright scarlet, tipped with green.

A. picta.—Leaves large, deep green, spotted with yellowish-white, spiny at edges; spike many-flowered: flowers large, bright scarlet, tipped with green.

A. plicatilis.—The Fan Aloe; leaves arranged in two-ranked manner (distichous), glaucous, unarmed; flowers red, tipped with yellowish-green.

A. rhodacantha.—Leaves broad, bright green, and margined with red spines; flowers red, tipped with green.

A Saponaria.—A handsome bold-growing plant; leaves dark green, spotted with creamy white, edged with white spines; spike branched, many-flowered; flowers large, orange-scarlet, tipped with yellow.

A. succotrina.—Leaves narrow, glaucous, edged with white spines; flowers deep red.

A. variegata.—The "Partridge-breasted Aloe;" this beautiful plant is stemless; leaves thick and fleshy, bright green, irregularly branched with white; flowers pink.

A. virens.—Leaves narrow, spiny at edges, deep green; spike branched; flowers deep crimson.

Aotus.—This small genus, like so many of the Australian plants that ornament our green-houses, belong to the Pea-flowered section of the *Leguminosæ*. They are nearly related to *Pultenæa;* but whilst the plants in this last-named family have two ear-like appendages to the calyx, the members of this genus are entirely destitute of them; and hence the name *Aotus*, which signifies earless.

These plants are by no means difficult to manage, the soil they prefer being light sandy loam and peat in about equal parts, broken up rather rough, in order to keep it open and porous.

A. gracillimus is a slender-growing graceful plant with small leaves; flowers axiliary, densely set, making up long pendulous racemes of bloom, which quite hide the leaves from sight; colour red and yellow. May and June. Western Australia.

A. villosus.—A more erect-habited plant than the preceding, with small downy leaves, and bright yellow flowers, which are produced during June and July. Western Australia.

ALOE ARBORESCENS.

Aphelexis.—The plants found in gardens under this name really belong to the genus *Helipterum;* but as they have become so generally known as *Aphelexis*, it is not well perhaps to attempt an alteration here. They are all distinguished by slender

stems, having compressed leaves, clothed with a hoary tomentum. The flowers are produced singly, and are terminal. The peculiar dry and chaffy character of the petals renders them very persistent, and they are popularly known as everlasting flowers. All the kinds bloom during spring and early summer, and are very effective ornaments to the plant-house.

The soil best adapted for *Aphelexis* is good fibrous peat and sharp sand; a few pieces of charcoal mixed with the soil serve to keep it open, and are very beneficial to them. There are not many kinds; the best are here enumerated.

A. Barnesii.—Flowers large, rosy-pink.

A. macrantha rosea.—This is a more compact grower than some of the kinds, and is extremely handsome; flowers soft rose.

A. macrantha purpurea.—The finest variety in cultivation; leaves bright green; flowers large, dark purple.

Aralia Sieboldii.

Aralia.—A family of plants which give the name to the order, *Araliaceæ*, or *Ivyworts*, to which they belong. They consist of shrubs and trees possessing very ornamental characters in their leaves; but their flowers are inconspicuous; hence such plants have become popularly known as fine-foliaged, or ornamental-leaved plants, and commend themselves to the gardener and amateur, inasmuch as they produce grand and striking effects in the plant-houses at all seasons, but are especially valuable during the dull winter months, when flowers are comparatively scarce. Aralias, and many other fine-foliaged plants, are also of the greatest service for the decoration of halls, corridors, and such places; the smaller-growing kinds for decorating the dinner-table, and also for using in the flower garden in the open air, giving a rich and varied tropical effect, which is strikingly different from the foliage of our native trees, and that of the majority of the flowering shrubs usually planted in the borders. From their use in this manner, these plants are usually denominated sub-tropical plants. The use of this class of plants generally in the open air is described elsewhere, under the head of Sub-tropical Gardening. Besides the strictly green-house or sub-tropical division, there are several species of Aralia which are perfectly hardy, bearing strikingly beautiful leaves; but we refer in this place to those more especially which deserve a place in the green-house or conservatory.

The soil for Aralias should consist of two parts rich loam, and one part peat and leaf-mould together. They enjoy a liberal supply of water. With these essentials there is no difficulty in their management.

The following will be a good selection:—

A. crassifolia, an erect handsome plant, attaining a height of between twenty and thirty feet, with alternate linear-oblong leaves, which are thick and

coriaceous in texture. In different stages and ages of its growth, this plant would appear to assume distinct characters, insomuch that these different forms have received specific rank. Thus in some instances the leaves are narrow, one to two feet long, dull purple, blotched with emerald-green, and this form has been named *Crassifolia punctata;* again, the leaves from old plants become bifid, or even trifoliate, and in this state it has been named *heteromorpha*, and *trifoliata;* whilst the younger leaves, from which the name of *Crassifolia* is derived, are oblong-acute, tapering towards the base, with a broad obtuse apex, and are sinuate or lobed at the edges. Widely distributed in New Zealand.

A. papyrifera, or *Fatsia papyrifera*.—This species is highly ornamental, and is much used in the subtropical garden. Its stems, however, are usually killed in winter, but young plants come up from the roots in the following spring; the pith of the plant is known as the Chinese rice-paper, and is largely used by the natives of the Celestial Empire in the formation of artificial flowers, animals, &c., in which they display exquisite taste. This plant usually attains a height of about six feet; sometimes it reaches to ten feet, but very rarely exceeds this size. The stem varies from three to six inches in diameter; leaves borne on long foot-stalks, palmate, five to seven-lobed, soft in texture, and densely clothed with a pale tomentum, as are also the branches and flower-spike. It is peculiar to the Island of Formosa.

A. pentaphylla.—A handsome, but comparatively dwarf species, bearing its five-lobed leaves on long foot-stalks, which are deep green and serrated at the edges. It is admirably adapted for all purposes of decoration. Japan.

A. pentaphylla variegata.—A form of the preceding, having the margins of the leaves broadly margined with yellowish-white, which renders it a most attractive object. Japan.

A. Sieboldii, more correctly *Fatsia Japonica*, is a bold plant, bearing an umbrella-like head of large palmate leaves, which are deeply lobed, slightly serrate at the edges, very firm in texture, and of a bright shining green. Japan.

A. Sieboldii aureo reticulata differs from the species in the midribs of the lobes being white, and also having the whole blade of the leaf closely reticulated with fine yellow lines. Japan.

A. Sieboldii variegata.—The leaves of this variety are profusely blotched with white, which also generally forms a continuous marginal band—a very attractive form. Japan.

A. Sieboldii aureo variegata resembles the last variety in all particulars except colour, which, instead of white, is here rich yellow. Japan.

Araucaria.—This is a genus of Conifers, containing a few magnificent trees; one species, *A. imbricata* (the Chili Pine), is hardy. The species here enumerated attain a great size, and although extremely handsome in a young state, it is only in large conservatories and winter gardens that their full beauties can be developed. The soil best suited to the requirements of Araucarias is good strong loam; like all Conifers they require thorough drainage to keep them in health and vigour.

A. Bidwillii is called Bunya-Bunya in its native country, and forms a majestic tree some 150 feet or more in height; the branches are arranged in a very symmetrical manner; leaves flat, ovate-lanceolate, hard and sharp-pointed, deep heavy green in colour; the fruit is a very large cone, with reflexed hooks upon each scale. Moreton Bay.

A. Braziliensis.—A rapid-growing kind, with large, flat, pungent, dark green leaves; it is rather lax in growth, but, like all the species, very symmetrical, and where space can be afforded it soon forms a very ornamental plant. Native of Brazil, where it attains a height of 100 feet or more.

A. Cookii.—Named in honour of the famous navigator, Capt. Cook, it is sometimes called *A. columnaris*, in reference to the beautiful habit it takes on when it attains size. It is similar in appearance to *A. excelsa*, but its branches are stouter, and it is altogether a more robust tree, and attains a height of nearly 100 feet. New Caledonia.

A. Cunninghamii.—This is a magnificent and very symmetrical plant, named in commemoration of the celebrated botanical traveller, Cunningham; the broad and flat branches are arranged in whorls, and assume a very graceful habit, which will be fully understood by a reference to the illustration; the leaves are bright rich green in colour; it attains a height of 60 to 100 feet. Moreton Bay.

A. Cunninghamii glauca.—Somewhat more robust in habit than the species, and the whole plant is beautifully glaucous, instead of bright green, which renders it very distinct and attractive. Moreton Bay.

A. elegans.—For a member of this genus, this is a somewhat dwarf plant, and is one of the most handsome in a young state. New Caledonia.

A. excelsa (the Norfolk Island Pine) is a grand and symmetrical tree, as our illustration aptly shows, with broad, flat, dark green branches, which have a beautiful drooping habit; it is an invaluable plant for decoration in a young state; it attains a height of 100 to 150 feet. Peculiar to Norfolk Island.

A. excelsa Napoleon Baumann.—A rare and very bold-growing variety of the preceding species, with rich dark green leaves and branches.

A. Rulei.—This species is the most robust grower in the whole family, except the hardy Chilian kind;

ARAUCARIA CUNNINGHAMII.

it has only been seen in this country in a comparatively small state, although it attains gigantic proportions with age; the branches are very stout, with closely-set deep green leaves. New Caledonia.

A. Goldieana is a plant of recent introduction, and very elegant; it is apparently intermediate in growth between *A. elegans* and *A. Rulei*, whilst it retains the beauties of them both. New Caledonia. This will probably become equally popular with *elegans* as a fine foliage plant, few plants affording a more pleasing contrast to the usual flowering and other plants used for conservatory furnishing, than healthy young plants of these species and *Cunninghamii*.

THE KITCHEN GARDEN.

By William Earley.

GENERAL MANAGEMENT.

Artificial Waterings do not receive such an amount of countenance and support as they deserve. This happens owing to a common practice which exists of giving occasional or frequent surface sprinklings, which during dry weather periods do not support the root-demands, and are, as a natural consequence, of indifferent result. Such waterings, to be effective, should be copious and abundant for the moistening of the soil throughout down to the

Araucaria Excelsa.

root-base. They should be given at least once a week during hot dry weather; and so soon afterwards as the soil becomes sufficiently dry, a deep hoeing to the soil should follow. The latter process neutralises the surface-caking, burning tendency of direct sunshine, and retains the water given within the soil. Water exposed to the air is always preferable. When, therefore, a pond or minor ponds can be formed within the garden, as described elsewhere, the advantage will be, as suggested, great. Surface mulchings have dual advantages if given previous to waterings. Manurial support is by their means washed down to the roots during the waterings, and there is more perfect retention of the water, owing to a further neutralising of evaporation. All artificial waterings should be applied during dull weather, or else during the early morning or afternoon. To water such plants even superficially at mid-day under a hot sunshine may have injurious effects.

Summer Culture.—Hoeing and weeding, so intimately associated with watering and growth, though such simple operations, are often performed very injudiciously. The whole should consist of one and the same operation, which, if timely and judiciously done, is an immense aid to plant-growth.

All cultivated plants develop wonderfully under deep soil-stirring, or hoeing beside and around them. Hence it is that during the whole period of growth the surface soil should be kept quite free. This is easily done by hoeing always so soon as the surface is dry enough, following heavy rains. Proper hoeing is to move the whole of the surface soil to a depth of two to four inches. Simply scraping over hard surfaces, in view of beheading or grinding off weeds, is the very extreme of indifferent and bad culture. Periodical hoeings, such as suggested, are easy and agreeable work; whereas neglect, whether enforced or not, entails a most laborious process, as it is inefficient in meeting the need in view. It will be seen besides, by this system, weeds will only exist in an occasional minute and unobserved form, decreasing the chances of seeding, and all the subsequent progeny of descendants.

Cropping systematically followed, or in other words, rotation and change of crops, is of immense advantage, not only because various crops take from the soil distinct and separate constituents, but also owing to the consideration that different sorts disintegrate and "work" the soil very variously. Some are superficial, others deep-rooting, &c. By change, therefore, profitable successions are insured. Thus Peas follow Celery; Cabbages, Onions; Turnips, Potatoes, &c.

Kitchen gardeners are greatly behindhand by comparison with market-garden farmers in the production of bulk from given spaces. Moderately thick cropping is essential to profitable cropping. It has merits beyond the actual margin of bulk obtained, for it lessens labour. For instance: hardy Greens, Cabbages, Broccoli, Turnips, &c., are planted or sown so thickly as to insure, after one good hoeing, that the leaves meet sufficiently to deter the growth of weeds, and thereby maintain more moisture in the ground beneath than is possible when the soil on either side is more or less bare.

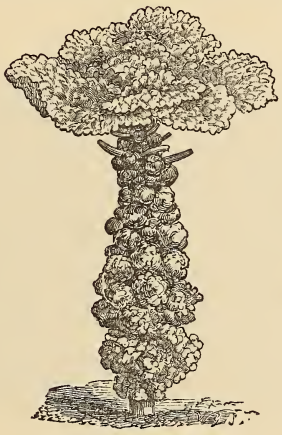
This fact has some bearing in connection with all minor succulent vegetables also. However well the surface soil be hoed, &c., during continuous arid periods, the action of the sun is such as to unduly dry the soil in the vicinity of the roots. Where crops are just so closely grown together as to about meet, all this is avoided, and the plant's shade is all-powerful: Lettuces, Endive, &c., along with the above being plants in point. Too thick planting and seedling-growing is equally objectionable, if not more so, and is a too general error. It is impossible for any individual plant to attain to a good size, when two or three young seedling or other plants are crowded together upon such space as is capable of maintaining the single plant only. These remarks apply to all kinds, but especially to Spinach, Turnips, Radishes, and all plants which require space to show distinct individuality before actual merit is possible. The thinning out of all seedling plants is therefore a matter of much importance, and it is essential that this be done at the earliest moment possible after the young plants assume the fourth or fifth leaf. The practice of hoeing out surplus seedling plants is also an important and a useful one. By loosening the soil around such as are chosen to remain, more inducement is given for the primary roots to travel downwards, whilst other young roots are also induced to push from around the base of the plant, owing to the latent moisture thereby retained, and the more favourable state of the soil for root-progress.

The practice of growing certain crops, such as Onions, Carrots, &c., in beds should be discontinued. This practice increases labour without compensatory returns. Drill-rows, across the quarters or borders, are to be preferred. By their use, subsequent hoeing can be more rapidly done, weeds thereby destroyed, and in due course the needful thinning out of all where too thick can also be accomplished.

Seasonable Operations should be undertaken to date as exactly as possible, without which it is impossible for perfect order to reign and all crops in season to be secured. Whatever the weather be this day, or this month, the divisions of the year alter

not, really. Hence, if owing to the weather, &c., important operations are deferred, many important results anticipated at the proper time will be deferred also, if not entirely *nil*.

Transplanting Seedling Plants is an important operation, upon the proper performance of which much depends. More good crops of vegetables are destroyed in the seed-pans and seed-beds than owing to any indifferent system of after-culture. Such tender young seedlings, overcrowded for any length of time together, and overdrawn, are, to say the least, so enervated that they cannot possibly reassume such a degree of initial vigour as to ultimately grow into the most meritorious of their kind. "Pricking out" such tender sucklings, or transplanting them thickly together in an early stage, so as to insure strength to each, prior to another and sometimes a third and final transplanting, is in practice greatly neglected. Thus are observed seed-pans with Celery, &c., placed aside for a convenient time for such work, whilst the first transplanting should have taken place, and progress in growth be reported. Thus the delay limits future growth, and often is the cause of that "bolting," or running to heart, or "seed," so often complained of. Nature has a very wonderful power in the revival of her checked and stem-hardened seedlings; not sufficient, however, to reassure full vigour. With a loss of time, a limit of season takes place, which cannot be reimbursed. It will appear, therefore, an act of folly to sow seeds so early, and to subsequently permit them to suffer in the infant and far most delicate state of existence.



Brussels Sprouts.

Doing Work in Season has an important bearing on the whole ultimate success. Thus all seedling plants should not only be transplanted as quickly as possible after the attainment of the necessary size, and the knowledge that they cannot make further advance within the limits of seed-pan or seed-bed, but, as regards such as are transplanted into open borders, a showery season should always if possible be selected for the operation. When this is not practicable the later part of the day should be chosen, and superficial waterings, with aid from temporary shadings, applied. None of these things should be left to chance, in the belief that the examples treated will succeed somehow. These remarks apply particularly to Celery, Lettuce, Cauliflower, and similar subjects, which depend upon an uninterrupted growth from the seed-leaf onward, to insure the full measure of success. Similarly, hoeing done just when the ground is changing from moist to dry is far more efficient and more easily done. Waterings undertaken before the soil is parched have, with half quantities, double merit and assistance to all roots. In a word, to succeed thoroughly throughout this department, a large amount of foresight must constantly command the position and the labour.

Exhausted Crops.—Do not permit these to remain on the ground beyond such time as they are in profitable use. Whether they consist of stalks of the Brassica tribe, haulms, vines, or "running" and seedy Spinach, Lettuce, &c., they prove not only unsightly, but tend to greatly impoverish the soil. In the case of all such, wherever permitted to remain beyond their wonted time, it is easy to determine that labour is either excessively handicapped, or the gardener is indifferent as to the future.

CULTURE OF VEGETABLES.

Brussels Sprouts, or **Brussels Borecole** (*Brassica oleracea*, var. *sabauda*). French, *Chou de Bruxelles;* German, *Kopfkohl Grüner.*—The vegetable so popularly named "Brussels Sprouts," from the fact that it was originally introduced from the neighbourhood of Brussels, has ever proved one of the most reliable and useful for winter uses. It is most constant in form, and hardy. Its efficient culture is very simple.

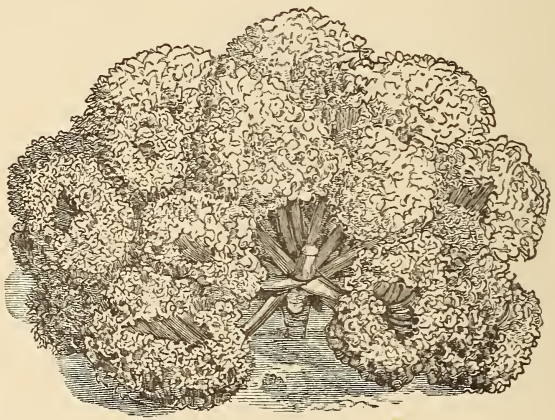
Sow seeds, as recommended for Broccoli, during the months of March and April. Where convenience exists, it will repay to sow them somewhat earlier in boxes, or broadcast within frames. The young seedling plants cannot be prepared and permanently planted too early, whatever system be followed. So soon as large enough, plant them out, from two to three feet apart, in any generous soil, which has been prepared also as for Broccoli. Though two-feet distances will be ample as regards the last-sown and late young seedling plants, it is economy in the end to give abundant room to the early ones, without which the plants cannot grow to a large size, and a good crop of fine sprouts cannot possibly be secured. Care must be taken not to plant the young plants too deeply; though they are known to produce roots around the buried stalks when they are buried, the growth is retarded rather than improved ulti-

mately. Mould the rows up when the plants commence growing freely, and continue to hoe amongst them as frequently as needful to keep the surface of the soil somewhat free. During arid periods, about midsummer, it is very advantageous to give artificial aid occasionally in the form of manurial waterings. These, if given at all, should be copious, and when once commenced should be continued weekly during the continued prevalence of dry weather.

Early and fine-grown plantations often commence to shed their lower leaves towards autumn. It is a good practice, when this is observed, to go carefully through the plantation and remove such as will part freely from the stems, clearing them right away. By this means air and the remaining influences of autumn sunshine will penetrate more freely and ripen them better, hastening the production of the sprouts from above the axils of past and present leaves.

The practice sometimes followed of removing the heads off the entire plants at the approach of winter, under the fancy that better sprouts are produced, is a fallacious one. Doing so causes injury to the crowns, limits the successional supply, and hurries such sprouts as do exist to the flowering stage unduly.

The produce of Continental seeds is as meritorious as any; English seeds from selected growths being good when procurable. For large sprouts the Rosebery may be grown with advantage. Approved varieties comprise—Aigburth, Rosebery, and the Wroxton.



Borecole, Curled Winter.

Borecole, or **Kale** (*Brassica oleracea*). French, *Chou vert;* German, *Blätter Kohl;* Spanish, *Breton.*—Borecoles have generally of late years been called Kales. They consist of curled-leaved varieties of the Cabbage tribe, not given to heart in any degree, and stand midway between the single-hearted Cabbage and the multiple-hearting Brussels Sprouts. They are esteemed as tender vegetables, possessing the merit of great hardihood, and are used mostly in the early spring months, when "greens" generally are scarce. Their culture is simple, and similar to that of preceding crops, excepting that they may be planted more thickly together, and that they grow freely in all kinds of soil.

Dwarf curled varieties, called both Scotch, and German Buda, and an intermediate form named "Cottager's Kale," from which spring some singular variegated-leaved forms, are all more or less grown and appreciated. The young crown shoots and leaves are first used, and then the side-shoots which succeed them.

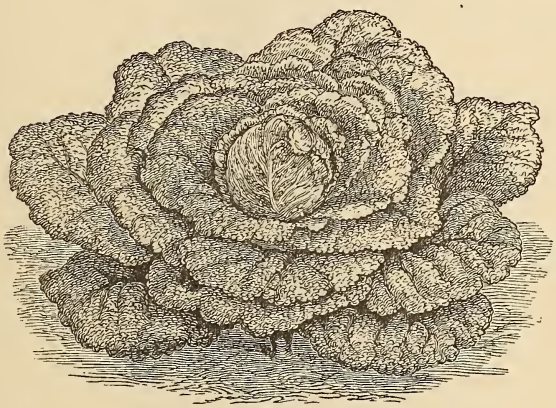
The best varieties comprise—Asparagus, Cottager's Kale or Buda, Dwarf Green Curled, and Variegated, which is used for garnishing purposes. One variety of the latter, Melville's Garnishing, so far exceeds most others in the richness and variety of its vivid colouring, that it is often raised in considerable quantities late in the autumn, for planting out in winter gardens and shrubberies for its decorative effect. Viewed from a distance no plants can compete with them in colour throughout the winter and early spring. Some even appreciate them so highly as to use the richly-coloured leaves for table and other decorative purposes, and there really are occasions when they look exceedingly appropriate.

The Asparagus Kale, and another variety much prized by some, the Couve Tronchuda—more of a Cabbage than a Kale—differ widely from others, and while among the hardiest and sweetest Kales for winter and spring use, are often either taken up and placed in Mushroom-houses, or other warm places in the dark, and fresh growth forced, which can hardly be distinguished from Sea-kale. Or the plants may have pots placed over their crowns where they stand, and a few warm leaves or a little manure built up round them to force the fresh growth.

Cabbage (*Brassica oleracea*, var. *capitata*). French, *Cabus*, or *Chou pommé;* German, *Kopfkohl;* Italian, *Cavolo;* Spanish, *Repollo.*—The popular and abundantly cultivated Cabbage is a biennial plant, inhabiting in its normal form the sea-shores of both England and Scotland. Known originally, doubtless, as "Colewort," it has been gradually improved

until the present compact and solid-headed varieties have been secured.

It will succeed in almost any kind of soil prepared and manured by the usual process of digging, &c., having a preference for light stony soils. Where these are available, however, it is well to have the needful space dug over a few months before planting. All heavy tenacious soils may be planted as soon as prepared. The main and most appreciated crop is that of spring and early summer, and is grown as follows:—Sow seeds of an approved variety from late in the month of July until August 11. The earlier date is a proper one for the southern parts of the island, later ones being more suited for the north, owing to the fact that if the seeds are sown too early the plants become so large ("forward") as to be incapable of withstanding winter severities. The seeds are sown broadcast upon a finely-prepared border, and the plants are drawn so soon as the earliest possess three or four leaves, and transplanted into beds very thickly, so as to forward their growth and give room for succeeding seedlings to attain more robustness in the seed-bed.



Curled Victoria Savoy.

Having prepared the permanent winter beds, it is well to plant out a certain number during each of the two months of October and November. Plant them in rows, thirteen to fifteen inches between rows, and nine to eleven inches from plant to plant in the rows. Towards the south and around London, place the roots of the plants as shallow as possible, with certainty of their being well covered with soil; and the more north the deeper let them be, to protect the stem from severe winters.

As soon as such plants take hold of the ground and commence to grow, mould them up deeply, drawing half the soil between the rows up to each row, and on both sides. When the most severe weather of winter is past, look carefully through the plantation, making good any plants lost; draw a little fresh soil up to them, and well hoe the space between each plant. This crop will come in during the months of April, May, and June. Each head must be cut immediately it is ready for use, removing at the same time some of the old leaves remaining attached to the stalk. A goodly crop of sprouts will ultimately form upon such, which will assure a good supply through a greater portion of the next winter. The only attention needed is to hoe well between the plants, to keep the weeds down.

Excellent varieties are Early Dwarf York, Enfield Market, Early Rainham, Defiance, Little Pixie, Hill's Dwarf, and Wheeler's Cocoanut. Couve Tronchuda, the "Sea-kale Cabbage," and Chou de Burghley (Cabbage Broccoli) are interesting additions to large collections.

Cabbage-Coleworts, known in market gardens as "Hardy Greens," are grown to meet the demand at such times as Cabbages proper do not exist; and as an aid, a few Cabbages — Early York — are sometimes cultivated in gardens. Seeds of the common Coleworts, or that named Rosette, are sown for these crops during the months of March, May, and July. The seedlings are forwarded in the same way as those of the larger Cabbage, and are transplanted into rows one and a half to two feet apart, and about four inches apart in the rows; so thick, in fact, as to admit of every other one being drawn for immediate use when the crop in the rows becomes at all thick, which leaves room for the remainder to grow and heart properly. So planted, a hoeing and one slight earthing up is all the crop requires. It so quickly covers the whole ground as to stop the growth of seedling weeds. By transplanting the young plants produced from the three seed-sowings above, an ample supply of Greens in the young state and minute white-hearted Cabbages is secured, obviating the necessity of retaining the old Cabbage-stalks referred to above; and it is a far neater mode of procedure.

Cabbage, Red, or **"Pickling,"** from which the "Sour Krout" of the Germans is made, is a variety of the white-hearting Cabbage, and requires similar treatment. For the future year, sow seeds in the

month of August, thin the seedling plants out somewhat, permit them to remain in the seed-bed until the month of March, and transplant in rows.

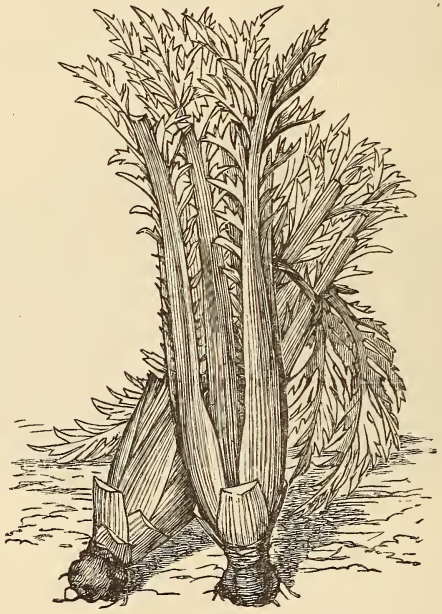
Sow seeds also in the month of March, and transplant into deep, stiff ground, as early as the plants become large enough so to do.

The produce is always more crisp and appreciated after it has undergone frosts; though, as this often spoils appearance, they are despatched to the London markets before they are likely to experience any. Dwarf, highly-coloured selections exist, and should be sought for, in seed form or as young plants.

Cabbage, Savoy (*Brassica*, var. *Sabauda bullata*). French, *Chou pommé frisé*.—This, the "Blistered-leaved" Cabbage, from which is supposed to have originated the Brussels Sprouts, possessing as both do a kindred flavour, is essentially a winter vegetable. Formerly it was grown in large form, to which was given the name of Drumhead. Now, however, dwarfer selections gain precedence. It is noteworthy, as one of an extensive family, that to grow it well, very generous treatment must be given and maintained; without which it is likely to prove a poor crop, and more subject to finger-and-toe, or club-root, and the attacks of aphis pests, mildew, &c., to which the whole are more or less liable. Seeds should be sown during the months of April and May, not too thickly, upon well-enriched soil. The site whereon they are to be planted permanently must be open, and exposed to the full air and sun. Unless the soil be deep and in excellent heart, trenching to a depth as nearly approaching four feet as possible is desirable, adding in the process manure with liberality.

Transplant the seedling plants, as soon as large enough, during showery dull weather, watering them if necessary. The earliest plants require a space of two feet to two and a half apart all ways, when the larger type is grown, one foot and three-quarters being enough for the dwarfer kinds. For early autumn those which approach the green form are best, solid-hearting white next; the Drumhead type are best for midwinter. These latter are not so good, however, until they have been subjected to frost. Deep hoeing and moulding up is beneficial, and this should be done two or three times during the earlier stages of summer growth.

The most popular varieties of this Cabbage are Drumhead, Dwarf Green (curled), Universal, Early Dwarf Ulm, and Bœmenihal, or Yellow.



CARDOON (TOURS).

Cardoon, or Chardoon (*Cynara Cardunculus*). French, *Cardon;* German, *Kardon;* Spanish, *Cardo Hortense*.—A perennial plant introduced from Candia, not unlike the Globe Artichoke in appearance, the midrib of the leaf, &c., being used for stewing, salads, and soups. Though of considerable repute on the Continent, it is not often cultivated in this country. A deep sandy soil, moderately manured, suits it best. Sow seeds on a warm border about the middle of April. So soon as the plants are well above ground, thin them out to about four inches apart. Prepare the permanent space for them either so as to plant them singly four feet apart, or in rows similar to Celery. Make a trench for the latter, and lower the soil where each plant is to go; in connection with the former method choose a rainy period during which to transplant them, taking each up carefully so as not to injure the roots, and reduce the leaf surface by cutting off a portion of the point evenly. Well water them in after planting. Between the months of August and October inclusive, the plants will have grown greatly, especially if aided by occasional copious waterings, when hay-bands should be used to tie the whole of the leaves up tightly together, similar to Celery when blanched. Then earth them up all around deeply and well, excluding the air from entering amongst the leaves at the apices, adding more soil as needed, whilst active growth continues.

Carrot (*Daucus carota*). French, *Carotte;* German, *Mohre;* Spanish, *Zanahoria;* Italian, *Carota.*—As a native perennial plant, the Carrot is more hardy than is generally surmised, for which reason crops may be secured earlier each summer than is customary. It stands apart, however, in regard to the kind of soil which is alone suitable to it, as it will succeed thoroughly in a deep, very free, sandy loam only. For which reason certain districts in Bedfordshire and elsewhere have become noted for its culture.

In view of this the freest, most sandy portion of vegetable grounds should be chosen wherein the annual crop is to be grown. It should also be one freely exposed to air and sunshine. Where gardens are naturally damp, and with adhesive tenacious soil, those who appreciate the crop will do well to add light, sandy materials as much as possible thereto on every favourable opportunity.

In the case of stiff soils, autumn trenching, or turning up, is essential. Manure will always be best placed six or eight inches deep, and it should consist of such as is moderately decomposed.

The earliest sowings, which should consist of the Short Horn type, of which excellent varieties of French origin exist, may always be made during a mild period in the month of February, wherever a warm sunny border exists. These are to be followed by a general sowing, towards the end of the month of March, or very early in April. Well fork over the previously dug and worked ground, breaking up all lumps; rake finely and level. Make shallow drill-rows fifteen inches apart, sowing the seeds thinly therein. To insure this it is desirable to mix a little dry sand or soil with them previously. Lightly draw the rake across the rows to cover the seeds in, drawing off at the same time all stones, &c., which lie upon the surface.

So soon as the young plants are well up and discernible, hoe carefully up and down the rows between them. When large enough thin the young plants out to six or eight inches apart in the rows.

It is excellent practice to sow a few rows of the Short Horn variety besides the main crop, at the same time. The drill-rows need not be more than ten inches apart, and the young crop may be used continuously after it has become large enough, in process of thinning, until the time arrives when such as remain can be "drawn," and stored away with the others.

The sorts which are most esteemed at this date are Intermediate and Long Red. As young crops are always greatly appreciated, other sowings of Short Horn may also be made about August 1st and October 1st for drawing so soon as large enough. At the approach of winter the crop is carefully dug up, each root having its crown neatly cut off, and the custom is to store them neatly in a stack, heads outward, filling in the spaces between, and covering all over, with sand, &c. A better plan, in view of keeping them fresh and succulent, is to clamp them out of doors in a similar manner to that which is followed with Potatoes.

Short Horn varieties are very easily forced in frames, and are especially early, sweet, and edible when grown over a heap of fermenting material, upon which a nice depth of free soil has been placed, covered over with a frame, and attended to in the matter of air-giving, watering, &c. As the crop and season advance, the lights may be entirely removed for use elsewhere.

The best varieties are Early Nantes and French Forcing (Short Horn), Dutton's New Intermediate, James's Intermediate Scarlet, and Long Red Surrey, for main crops.

Cauliflower (*Brassica oleracea*, var. *botrytis*). French, *Choufleur;* German, *Blumenkhol;* Italian, *Cavoli fiori;* Spanish, *Coliflor.*—Where the several members of the *Brassica* family previously referred to will succeed, there also will the Cauliflower grow; though, owing to its superior merits, it is deserving of far more attention, and amply repays every additional outlay of labour and manure expended upon it. A deep sandy loam, highly enriched with manure, gives the best possible results. It is treated both as a biennial and annual.

Seeds are sown during the first and third weeks in August, and the young seedling plants resulting therefrom grown on in the seed-bed if, owing to dry weather, they have not made any great advance; or transplanted singly into nursery beds, when a damp growing period ensues, in view of checking too great a growth, until the approach of winter, when they are transplanted thence into cold frames, having the bed of soil made up to within six or nine inches of the glass; or into hand and bell-glasses, from five to eight plants under each; where, aided by abundant air-giving during all mild periods, they are kept hardy and strong, in view of withstanding the severest frosts, and retaining robustness for early spring growth and flowering. During the month of April subsequently the plants in the bell-glasses are thinned out, and, along with those wintered in the cold frame, are planted out on to an eligible piece of ground, there also to grow and bloom. Meantime, from three to five plants are selected as the strongest to remain under the hand-glasses, receiving air as needful and manure-water occasionally. These head in for use towards the end of May, and usefully precede those planted out. The variety used for this purpose is one long known as Early London.

Other, or summer, varieties are numerous, the seeds of which are sown during the months of April and May to secure successional crops, the seedlings from which should be planted out upon very rich, somewhat stiffer or damper soil, being mulched around and watered as the exigencies of an arid summer may demand. These head in towards the middle and end of summer.

A very valuable variety, named Veitch's Autumn Giant, should succeed the last-named. Sow seeds of this variety also during the month of April. Grow the plants on in soil, &c., similar to that recommended also for the last, earthing the young plants up deeply as they grow. The huge heads resulting fill in the gap between early autumn and the first frosts of real winter. By pulling up the plants having heads within at the approach of frost, and hanging them up by the root in a cool dark shed or cellar, they last some time in a state fit for use. Many improvised methods are practised in view of prolonging or extending the usefulness of this invaluable crop, which, in connection with Broccoli, gives a supply, more or less, the whole year through. Our directions are such as to leave a margin for other methods of supply, though for the main crops the suggestions given are indispensable.

Excellent varieties are Early London and Dwarf Erfurt for early spring use; Eclipse, Asiatic Large, Snowball, and Walcheren for summer and autumn uses.

THE VINE AND ITS FRUIT.

By William Coleman.

VINE BORDERS.

IN the formation of vine borders it is usual to allow the roots a body of compost equal in width to that of the house. A house fifteen feet in width will require six to eight feet inside, and about the same breadth outside, by the time the vines come into full bearing; but instead of making all at once, it is best to form half the inside border the first year, add three feet outside the second year, and so on, adding fresh compost from time to time as the roots require more soil. The depth may vary from two feet to two feet six inches, and there should be not less than from twelve to twenty-four inches of drainage, to carry off the water and keep the border dry, warm, and well aërated. It will thus be seen —the surface-line of the border having been decided upon—that a depth of four feet below the front sill will be needed to admit of a layer of concrete and eighteen inches of broken brick, stone, or lime rubble for the soil to rest upon. In cold, low-lying gardens it will not be advisable to strike the surface-line on the ground-level, but to raise the foundations of the house and economise labour by raising the borders in like proportion.

In selecting the position for a set of vineries, it may be assumed that the situation, while being sheltered, is sufficiently high to admit of natural or easy drainage, as it is generally conceded that vines do not succeed well where the subsoil is cold, wet, and liable to be inundated, either from above or below, with flood or spring water. If every grape-grower could make his own choice, he would select a warm sunny slope, where natural drainage would carry off all surplus water, and ground springs would not trouble him. But as many old gardens do not offer these advantages, the first thing to be considered is a perfect system of drainage, considerably lower than the front of the external border, a good sound bottom of concrete, some three inches in thickness, and clean drainage, which may vary from twelve to twenty-four inches, according to the position of the garden and the nature of the subsoil.

Drainage.—As it is well known that an efficiently drained border is much drier and warmer than one that is water-logged and impervious to an under-current of air, a good barrel-drain should run along the front of the excavation, for the reception of the water as it passes off the concrete placed over the subsoil. The concrete should have a gentle slope outwards, as is shown in the sections, and it should be laid down some days in advance of the drainage, to get thoroughly dry and hard before it is excluded from the external air.

Having at hand a supply of broken brickbats or sandstone—two materials which will be found warmer than limestone, as they absorb while the latter condenses moisture—wheel them in as soon as the concrete is hard, and form the foundation for the first moiety of the border, by placing the roughest pieces at the bottom and the finest on the surface. As success or failure very often depends upon the way in which the border is drained, no pains should be spared in finishing off the surface, by carefully breaking and levelling the last layer of rubble, and filling up all the interstices on the top surface, otherwise the soil will in course of time get into the drainage, roots will follow, and a gross growth of wood and foliage, a disinclination to go to rest, and a tendency to shanking, will indicate that this part of the work, no small item, will soon have to be gone over again.

Soil, or Compost.—Notwithstanding the fact that the vine is found growing, if not flourishing, in

almost every kind of soil, from strong clay to sandy loam, in a thin stratum of light soil on the oolite or gravel, and deep alluvial deposits in our river valleys, it does not follow that all alike supply the materials necessary to its continuous fruit-producing power and longevity. If the question were put to twenty successful grape-growers, all would admit that good drainage is of the first importance, and all would agree that fresh virgin loam, which may include any kind of old turf from the side of a road to a stiff calcareous sheep-pasture, is necessary for the formation of the staple of the border. Beyond this, it is probable that every man would diverge, more or less, from the line which is to lead to the production of first-rate grapes. But with the numerous facts now before us there can be but little doubt that some fresh materials, pervious to the passage of solar heat, air, and water, be they calcareous or sandy, will form a suitable compost for a free-living plant like the vine. Often in the neighbourhood of towns, where new turf cannot be obtained, many people make a virtue of necessity, by using old garden soil, often heavily charged with organic matter, but quite destitute of fibre. This is made up and corrected with short horse-manure, chopped straw, road-scrapings, bone-dust, and charred wood and garden refuse, or a liberal admixture of old lime rubble. In a compost of this kind grapes generally colour and finish well, and where the outside borders are well mulched and watered in dry weather they do not often shank; but, as may be supposed, the vines do not last so long as they would do in the open country, where the grower has the run of an old sheep-pasture, or sloping hill.

Having shown that the vine is by no means fastidious, provided it can have a regular supply of fresh food, little and often, and that some kinds are better than others, the reader will now wish to be made acquainted with the details of the management of the materials, and the preparation of the compost. This should consist of two-thirds of good friable turfy loam, the fibre of which will not readily decay, and which will at all times be pervious to the free passage of water, of which the vine requires copious supplies. But lest this should in course of time become close, heavy, and inert, a liberal admixture of the remaining third should consist of lime rubble, charcoal, and burnt earth, with twelve per cent. of crushed half-inch bones added to insure a vigorous, short-jointed growth. If wire-worm is present, add a little soot. Chop the turf into rough squares with spades, mix well, and throw the compost into a heap to ferment, when it will be ready for use. No animal manure need be added, as young vines always grow freely enough in almost any fresh well-drained soil; but it may be used as a mulching to keep the roots near the surface, and so prevent them from striking downwards into the moist drainage, which is too often the first step towards shanking.

As success or failure very often depends upon the condition and preparation of the compost, it may be well to observe that the turf, be it rich or poor, should always be used freshly cut from the pasture, and on no account should it be cut or handled when in a wet condition. It is much better to defer all border operations than to persevere with the work when the elements are unpropitious.

Although the vine may be planted in an internal border at almost any season of the year, the best time for the operation is early spring; and as a little bottom heat is a powerful agent, it is important that the turf be newly cut and chopped some time before the vines are ready, when fermentation will set in and most likely raise the whole mass to a temperature of 90°. Before the compost is wheeled in, thin sods of turf, grass-side downwards, must be laid over the drainage, and similar sods may be used for building up the retaining walls of the border as the work proceeds. When the border is finished, the external turf wall, which will be exposed to the full force of the sun and drying winds, should be protected by means of thatch, or a lining of oak-leaves.

Exceptional Borders. — Hungry Soils.— As grapes are now grown in almost every parish in the United Kingdom, it is hardly necessary to remind the reader that there are many places, notably on the sandstones, the granite, or the oolite, so completely favourable to the free passage of water, as to render the precautions which have been laid down for unfavourable neighbourhoods unnecessary. On the gravel and sand many people think drainage or concrete quite superfluous; but this is a mistake, as all hot, hungry substances beneath a border, do positive harm to the vines when the roots get deeply imbedded in them. It is, therefore, well to guard against all hidden dangers at the outset, by laying thin layers of concrete and drainage, and making the borders a little deeper, in preference to having to encounter the expense and annoyance of doing imperfect work a second time over.

Cold Soils Subject to Flooding.—So likewise in cold, calcareous valleys, subject to flooding, the preceding directions may not be sufficient to meet isolated cases. In many places, where destructive floods pour down from the surrounding hills, or back-water from tidal rivers is a possibility, it is prudent to raise the borders above the ground-line, by means of two feet or more of drainage, and confine the roots to narrow, shallow borders, composed of extra-porous materials. In such situations, the concrete should

have a sharp slope to the front, and six-inch drain-pipes should be placed upon it in rows, three feet apart, running from the interior to the front, before the drainage is introduced.

Heated Borders.—Some years ago, heated borders were brought under the notice of grape-growers, and much discussion followed. But it is questionable if any one, save the raisers of young vines for sale, derived any benefit from the system. The usual mode of heating is to place hot-water pipes, either in tanks or rubble, and form the borders over them in precisely the same way as is usually adopted for Pines. When the pipes are placed in tanks, the soil is liable to become sour and pasty and unfavourable to healthy root-action. In rubble, the bottom of the border is apt to become too dry; the roots suffer from the opposite extreme; red spider follows, and the expense of putting in the pipes ends in disappointment and failure. Before the system of bottling late grapes came into general use, some kind of bottom heat was considered necessary for starting early houses in November; but with grape-rooms, in which the fruit can be kept fresh and plump until May, the system, which was little better than a trap for the unwary, has now passed away In the few places where early forcing is still practised, aërated borders are much more satisfactory, as warmth, ammonia, and moisture can be forced into the drainage in sufficient quantity to excite the roots in the compost immediately above it. As the borders for early work should always be internal, a series of drain-pipes, running quite through the drainage from back to front, and opening into areas wide enough for the reception of fermenting material, consisting of horse-litter and leaves, will do good service, as soon as the buds on the vines begin to swell. If applied earlier, the new roots are formed out of the stored-up sap, which should force the buds into activity. Independently of the benefit which may be derived from the warmth and ammonia, so complete a system of root-ventilation is always advantageous, particularly in low, cold, damp situations.

Water.—With all the other elements entirely under his control, the grape-grower would not be able to move one single step forward without an abundant supply of water; and yet how often do we see the greater part of the rainfall running away into the drains, or the provision for its retention so sparingly made, as to leave the puny tanks in a set of houses quite empty a few days after the rain ceases to fall! As special attention will be drawn to this important element in the papers upon Pines, it is not necessary to do more than refer the reader to those pages, and to say that the supply in the vinery is quite as imperative as it is in the pinery. Indeed, it is not an exaggerated assertion to say more vines are ruined through the want of water than from any other cause. Independently of the requirements of the roots, the daily syringing and damping must be carried out on a liberal scale; and as there is nothing to equal good rain-water, copious tanks should be provided for its preservation, if possible in elevated positions, for supplying minor tanks in the houses, and for use with the hose. Although many growers never think of giving artificial waterings to external borders, there can be no doubt that an occasional deluge, during the growing season, would greatly benefit the vines, at times when the strain upon them is more than the roots can sustain. But it is to internal borders that the greatest quantity should be given, not in driblets, but in quantities that will amount to something like a rainfall of thirty-six inches in the course of the growing season.

As no rule can be laid down for watering an internal border, the amateur will do well to saturate every particle of the soil before the vines are started, and to repeat the operation at short intervals from the time the leaves unfold until the fruit is nearly ripe. After that stage is reached less water will be needed; but the borders should never be allowed to become dry. After the last heavy watering, the surface of the border should be well mulched to keep in moisture until after the fruit is cut.

Covering Vine Borders.—Of all the operations in grape-culture, the covering of vine borders has been more frequently discussed and abused than all others put together: some maintaining that it is positively injurious, while others as strongly assert that it is absolutely necessary. With powerful arguments for and against it fresh in their memory, the majority of good grape-growers, very wisely guided by their own experience, have arrived at the conclusion that it is in the abuse, and not in the use, of fermenting material that many have gone wrong. Where vines having the run of internal and external borders are expected to produce ripe grapes in May, a good covering of fermenting oak-leaves, at all times preferable to manure, is undoubtedly of great service. This will not only protect the surface roots from the chilling effects of cold, rain, and snow through the dead months of December and January, but will also keep up a degree of warmth when the vines require all the assistance which nature supplies to them in vine-growing countries, where the heat of the soil never descends below temperate. But instead of applying the fermenting leaves at the time the house is closed, many prefer covering with bracken early in the autumn, to keep in latent heat, and putting on the

leaves when the buds are fairly on the move. If applied earlier the system is abused, as new roots are formed out of the stored-up sap contained in the vines, and the latter break weakly in consequence. Mid-season houses, which ripen grapes in June and July, may also have a good covering of dry leaves to prevent loss of warmth; but fermentation is not necessary, as the strain does not fall on the vines until awakening spring sets the roots in motion. When any description of covering is applied to early borders, great care should be observed in its removal, as this is the operation which so frequently brings covering into disrepute.

If carefully examined, say in June, when the grapes are ripe, the surface of a good border will present the appearance of a sheet of tender rootlets, to which sudden exposure is death. The covering should, therefore, be removed piecemeal, four to six inches being left as a mulching and protection until the wood is ripe in September, when every particle must be removed down to the solid staple of the border, preparatory to the autumnal dressing of bone-dust and a thin layer of new loam.

A steady surface warmth being highly important, a covering of some description, such as wooden shutters, glass lights, or tarpaulin, should be placed over, but not touching the fermenting material, to protect it from rain and snow.

Late houses may be thrown open as soon as the grapes are bottled in December, when full exposure of internal and external borders to the elements will do more good than covering; but they should be well mulched with rotten manure when they are started in the spring.

Renovating Vine Borders.—In nearly all good grape-growing gardens, where fruit of the finest quality is produced from year to year, the cultivator can never say his work is finished. One or other of his vineries, which have been producing full crops, early or late, over a long series of good and bad seasons, will gradually, sometimes suddenly, show a decided falling off in quality or quantity. Something must be done to arrest the downhill course of the vines, which may be perfectly sound and healthy, but decidedly weak. The experienced grower will at once make an examination of his borders, which in nine cases out of ten will be found to have become inert and heavy, and no longer capable of supplying the food necessary for the production of sound healthy wood and foliage, so essential to the growth of good grapes. To root out the vines and re-plant in a new border, means a heavy outlay and the loss of a crop for two or three years; but if he has followed the modern practice of planting inside the house, and has provided internal and external borders, renovation of one or other of these may be performed over and over again without the slightest risk to the vines, or fear of losing a full crop of fruit. There are various modes of renovating exhausted borders. Some remove the surface soil quite down to the roots and replace it with fresh compost, similar to that recommended for new borders; but this is only a temporary means of relief, as it does not improve the condition or position of the lower roots, which may have found their way into the drainage or through some chink or crevice into the subsoil, whence a supply of crude cold matter, which the vines cannot assimilate, is being constantly forced up, and is undoubtedly the cause of all the mischief. The best method which long and successful experience dictates, is first to decide upon the border to be taken out and re-made with fresh compost. The next effort must be the early maturing and disposing of the crop; as notwithstanding the fact that the work may be performed at any period after the grapes are cut and before the vines break again, the best time is during the ripening of the wood and foliage. At that time the buds are properly formed and the fully developed, but immature foliage, is in the best condition for again setting the roots in action after they have been disturbed. As so much depends upon getting the mutilated roots to form fresh spongioles in the new soil, which during the summer or early autumn months is naturally warm, no other operation, be it never so pressing, should cause delay, otherwise the sap will become comparatively inactive, and incapable of aiding in this important effort on the part of the vines. If internal and external borders supplied no other advantage, it must be conceded that they are of the greatest value when renovating becomes necessary; as one or other of them can be taken out with impunity, without in any way interfering with the quantity or quality of the succeeding year's crop.

Assuming then that the grapes have been cut by the end of July, and the leaves are quite fresh and green, throw a slight shade over the roof; then commence at the foot of the border by throwing out all the old soil quite down to the drainage; carefully trace and preserve all the roots, which must be kept moist and shaded from the sun, otherwise they will soon perish. When all the soil has been removed, sling the roots in bundles near the wall-plate, syringe well, and shade. Examine the drainage, and if not quite satisfactory, make it so by turning it over; then make up the new border, and carefully re-lay the roots as the work proceeds. As nothing succeeds like success, it may be well to direct attention to the following points. Use steel forks for getting out the roots, and never allow the latter to

become dry. Employ a strong body of skilful hands, as despatch is more than half the battle. Carefully prune any defective or injured roots as they are re-laid; keep them well up in the new border to allow for settling, and mulch with fresh horse-litter when all is finished. If the undisturbed border is pretty full of roots, the foliage will not suffer; but if it shows signs of flagging, allow the shading to remain on the roof, and keep the house constantly moist, close, and warm, to induce fresh growth. When this takes place, as will be easily seen by the bold, crisp appearance of the leaves, remove the shading by night and on dull days, gradually give more air, and by degrees allow the house to fall under the usual routine of management.

The uninitiated, often driven to despair by the down-hill course of their vines, by their persistent growth when they ought to be resting, and by the wholesale shanking of the grapes, will be astounded at the magic effect produced by lifting and re-laying the roots in new compost. Vines which produced long straggling bunches, with a strong tendency to run to tendrils, at once change their character and ripen off close, compact clusters, perfect in colour and finish, without which the highest quality cannot be attained.

Mulching.—At the close of the preceding paragraph on Renovation, the use of stable manure was mentioned as suitable for covering up the newly-made border. As this material is well calculated to admit the free passage of solar heat into the soil, while it is a preventive of evaporation, and this at a time when the new compost contains more food than the roots are in a condition to absorb, it is preferable to solid manure. But when the spring comes round and the roots are again in activity, a covering of three inches of the best spit manure will supply rich stimulating food, while it draws them upwards into the invigorating influence of the sun and air.

So also in the management of old-established external borders, unless the vines are very vigorous (when it may be deferred until after the fruit is set), lay on four inches as soon as they start into growth. In the case of old vines, the first mulching may be removed and renewed after the stoning process; but never after the grapes begin to colour. Internal borders require similar treatment; but being regularly watered with copious supplies of tepid liquid, they are better left without the manure until the fruit is set, as too much feeding sometimes leads to sterility.

Unless the soil of which new borders are made is very light and poor, this mode of stimulating the roots of vines is in every way preferable to mixing manure with the compost, as the latter induces a gross habit of growth for a year or two, and is the first ingredient in inducing an otherwise good border to become dead, pasty, and worse than useless by the time the vines ripen off their first full crop of grapes.

THE ROSE AND ITS CULTURE.

By D. T. Fish.

THE PROPAGATION OF ROSES.

THE science and practice of propagation generally will be treated separately in this work by the most competent authority. Hence it will not be needful to go deeply into the subject here. Nevertheless, no guide to Rose-culture could be complete, or become popular, unless it gave plain instructions in the art of multiplying their numbers with success and speed. The successful prosecution of this art brings a new pleasure to Rose-culture; that of something akin to parentage. It is well to grow Roses propagated by others; but the delight has a keener edge when the Roses have been reared by the growers. In not a few cases, too, the special knowledge of how Roses have been raised, furnishes valuable hints for their culture. Neither need the trade fear the competition of amateur growers. The more the latter raise at home, the more they seem to buy, for the desire for Roses is seldom or never satisfied. Some one has said that had they their garden full of Roses, they would still want part of their farm for a briar and budding ground. Another great advantage of home propagation is that only, or chiefly, those sorts that thrive in that given locality should be largely increased. For every rosarian to grow the same Roses is about as absurd as for all ladies to wear the same sized, shaped, and coloured bonnets. Rose shows are answerable for much of the Rose monotony that prevails in gardens. Local propagation will, it is hoped, do much to break this up. For, after all, not a tenth of the Rose-growers grow for showing at exhibitions; and for real pleasure give me a hundred Rose-trees of one variety, in robust health and perfect beauty, rather than a hundred distinct varieties, seventy-five of which look seedy or weedy. Of course the relative number here may be extreme, and yet in most gardens fully half the Roses grown do not thrive well in the locality.

The propagation of Roses resolves itself into one of seeds, buds, cuttings, grafting, layering, suckers, and root-division. We will take them all in order.

PROPAGATION BY SEEDS.

Unless for the obtaining of new and improved varieties, it is hardly worth while to raise Roses in this way. Seedlings can hardly flower till two years

old, some not till three, or even more, and the result is very uncertain; for, unfortunately, Roses are more prone to degenerate than most cultivated plants when raised from seeds. A large proportion of them, it may be ninety-five out of every hundred, will come single or worthless. Still, as single flowers are now the fashion, all the sweetest and most brilliant even of these should be saved for growing in the wild garden or shrubbery. Nevertheless, few will take the trouble of raising many Roses from seeds, while the result continues as now to be so many blanks in proportion to prizes. But in Roses, as in everything else, the cultivator reaps what he sows. Hence, the trade and others who make the propagation of Roses from seeds the business or pleasure of their lives, begin by attempting to improve the seeds themselves. This is done by careful cross-breeding or hybridising, by skilful selections of new strains, by perpetuating sports, and other means. (See articles on PROPAGATION.)

The rosarian's difficulties in these matters are increased by the fact, that some of the finest Roses cannot be seeded at all under ordinary circumstances. The transformation of pistils and stamens into petals piled on petals, has in such cases been so thorough and complete, that the powers of fructification are necessarily suppressed.

Still there are certain, and those chiefly what are termed thin Roses by rosarians, which seed freely and plentifully. Among these are all the briars, Austrian and English, most of the Bourbons, the Moss, Chinese, several of the Teas, and such Hybrid Perpetuals as Charles Crapelot, Madam Domage, Prince Camille de Rohan, Fisher Holmes, Jules Margottin, William Jesse, and the old General Jacqueminot. So freely does the latter seed, and so potentially has the parental likeness been stamped on its offspring, that there is rather more fact than fancy in the humorous receipt for new Roses once commonly in vogue: "Cut any number of General Jacqueminots, place them in your hat, draw them out blindfold, and name as you like." Among pink Roses the old Chénédolé, and Coupe d'Hébé, have been very fruitful sources of new varieties.

Cross-breeding consists in collecting the pollen of one Rose and placing it on the stigma of another of a different colour or character. (For mode of fertilisation, &c., see articles on PROPAGATION). When the seed ripens, the seedlings may be expected to manifest some of the features of either or both parents. It is by such simple means, as well as by chance fertilisation, that most of our new Roses have been raised. Of late years M. Bennet has followed this plan with considerable enthusiasm, and has been at last rewarded by such Roses as Lady Mary Fitzwilliam, Her Majesty, and several others of almost equal merit. Great patience and perseverance are necessary, as the offspring is often no improvement on the parent, but more frequently a reversion to a more primitive, and hence more worthless type. Still, where intelligent forethought is brought to bear rather than mere haphazard practices, a satisfactory result is rendered more certain, and its attainment more speedy.

Gathering and Sowing of the Seeds.—Whether any special efforts have been made to obtain seeds or not, towards the end of most seasons a considerable number of hips will appear on the Rose-trees. These should be gathered so soon as ripe, and laid out in the sun or in a hot-house to dry. Break up the hips, separate and clean the seeds, and either sow at once, or store safely in paper bags in drawers till the spring. Autumnal sowing, however, is mostly reckoned to be the best, and a warm, dry, sheltered border in the open air is considered the best place. Time may be gained as well as greater immunity from the ravages of mice and rats—both extremely partial to the sweet seeds of Roses as well as the more common hips of the Sweet-briar and other briars—by sowing the seeds in pots or pans, in pits or frames under glass. But the evils and risks of attenuation and mildew are thought to more than counterbalance the benefits of such safety and shelter as the glass affords. Spring-sown seeds seldom vegetate so soon or so freely as those sown as soon as ripe; time, though spent in the cold and wet ground, favouring the gradual swelling and earlier germination of the seeds.

The seeds may be sown in drills or broadcast. If the former, from six inches to a foot is a handy distance; from half an inch to three-quarters a suitable depth. If sown in drills, tread in the seeds, and rake smooth in the usual way. If broadcast, scatter half an inch or so of fine compost over the bed, and pat the surface firmly down with the back of the spade. This hardness and smoothness helps the seeds to germinate, and is also a most useful and much-needed indicator of the visitation of such pests as slugs, worms, rats, mice, or birds to the seed-beds. The former mow the Roselets off with their saw-like teeth before they are well out of the ground; the worms drag them into their holes; the birds pull them up to see if a sweet seed may be found at the roots; and rats and mice devour the seeds wholesale. To forewarn is to arm the rosarian with lime-water, and other traps and engines of destruction, to the saving of his seedling Roses.

Irregularity in Germination. — Amateur propagators will need to be cautioned under this heading. The seed-bed of Roses is as unlike a bed

of Cabbages or Lettuces as can well be. Instead of breaking ground all at once, the seeds spring forth tentatively, one or a few at a time, as their vital force moves them. Full half the seeds mostly lie dormant throughout the first year, and many never grow at all; the others spring forth at intervals of three or six months between the plants or batches.

Their irregularity of growth almost matches their varying times of germination. Some come up but to wither and die, as though all their strength had been expended in breaking ground. Others stand still for weeks, months at a stretch, and ultimately die; but not always, for occasionally these stunted ones grow with unexpected luxuriance, and manifest considerable merit. Others again grow away from the first as if they had been used to it; these extra-vigorous ones, however, mostly reverting into singleness.

Seedling Roses also differ widely in their age of flowering. Some have been known to bloom in six or nine months; others have been five years old before they blossomed. A few, however, bloom the first year, more the second, a yet greater number the third, though some are several years in flowering.

First Flowers.—The early flowers of seedlings may be relied on to reveal their colour, but scarcely any other quality. Neither size, form, nor substance of the blooms is formed or fixed for a year or two. It is most necessary to bear this in mind and act upon it, otherwise many of the best seedlings may be sacrificed before their merits are established. The qualities of seedling Roses and most other plants may be fixed sooner, and be more fully and speedily developed, when budded or grafted on other plants than on their own roots.

General Treatment of Seedlings.—In the open during the first year, the tiny plantlets, like their grown-up parents, need shelter, shade, water, and weeding. Rough winds must be broken, and severe frosts tempered, by the shelter of walls and fences, or boughs or bracken placed in, over, or among the Roses. Shade is also needful from excessive sunshine; otherwise, its fierce heat often withers up the more delicate seedlings in a few hours. Water should be given early in the morning or late in the evening when needful, to keep the soil fairly moist, as anything like flagging not only arrests growth, but invites the attacks of mildew and red spider, both most injurious and often fatal to seedling Roses.

Transplanting of Seedling Roses.—Towards the end of October or early in November, all the seedlings large enough to handle should be lifted; the roots, when long, are very slightly pruned, and the seedlings planted in fresh soil, in rows nine inches or a foot apart, and six from plant to plant. Tread the seedlings in firmly, and shorten the tops slightly when they are long and heavy.

Protect from severe cold as before, and prune the seedlings back to one of their best buds about two months after planting; keep clean, water when needful, and carefully cultivate throughout the summer, and so on for several years, till the whole have bloomed. Many of the seedlings will flower the second year, when the best should be selected.

When planting out the seedlings, any that revealed the Tea character and seemed specially tender should be potted up, and grown in a green-house, pit, or frame until they bloom.

During the second winter, and all subsequent ones until proved, the seedlings should be mulched with manure, and protected as already described.

After the third or fourth year nearly all the seedlings will have proved themselves, and selection and rejection may proceed with confidence, without fear of having discarded any Rose treasures.

After the removal of the forwardest and strongest plants, top-dress the seedling-bed slightly with fine soil or rich compost; beat down firmly with the back of a spade; dress with a sprinkling of soot and lime, to give a quietus to slugs and worms, and wait patiently for the second and other successive crops, which not seldom prove more fruitful alike of plants and merit than the first.

There are other modes of raising seedling Roses, more swift, but certainly not more sure; and this is within reach of all who have a square yard of garden ground and a few Rose-hips or seeds in their possession.

All this may seem slow and tedious on paper, but in reality it is not so in practice; and assuredly no means of propagating Roses equals the pleasure of raising them from seeds, which is so fruitful in pleasant excitement and sustained expectation. Hardly any two seedlings are alike in foliage, habit, prickles, or wood; and a Rose of surprising excellence, of a new colour or strain, may open at any moment, and establish at one bound the fame and fortune of the raiser.

Sports.—These may be described as new and short cuts to novelty in Roses, and most other plants. Notwithstanding all that has been written by Darwin, Masters, and others, on the origin and probable cause of sports, the laws that govern their development can hardly be said to be understood. Once, however, admit the theory of "pangenesis," the potency of germs and their latent powers of dormancy and development, and the possibility and even pro-

bability of sports follows as a matter of course. Bud-variation, though not so common as that of seeds, being exposed to far fewer disturbing causes, nevertheless exists, and may develop at any time into a sport that is some more or less striking variation from the ordinary type. In the present state of our knowledge, sports cannot be produced by art: fortunately, however, they can be fixed and perpetuated by the ordinary means of propagation. Some have thought that high culture may force sports. Be that as it may, a starving regimen seems the best for perpetuating them. And this is especially so in regard to all sports that take the form of variegated leaves. Most forms of variegation can be grown into verdure again by a forcing regimen. This fact furnishes a useful hint to the rosarian. So soon as a sport appears on the highway of evolution towards something better in size, form, substance, and colour, the plant should be left to finish its new departure in its own way, and no changes of treatment nor of food given till it has fixed its sport. Only once have I seen the old *Cineraria maritima* show a real golden sport, yellow as a guinea. The plant was at once lifted and placed in heat to force the golden branch into cuttings: from that moment it lost its gold, and went back to its normal whiteness with a double percentage of green in it. From that day to this I have never again met with a good golden sport on the old Cineraria. The sports of Pelargoniums, again, are well known. Perhaps the most striking example of this sporting family will be found in *P. Vesuvius*, one of the most brilliant of all the scarlets, which has sported into a pure white, a variegated-flowered, white and scarlet; a double-flowered sort, well called "Wonderful," and many others. Sports, however, are occasionally produced in almost all families of plants. From a full list of Roses originating in sports, in Carrière's work on the production and fixation of some varieties in vegetation, it seems that far more Roses have originated thus than is generally supposed. Carrière's list is as follows:—

From Rosa centifolia.—Cabbage-leaved variety; Lettuce-leaved variety; Celery-leaved variety; Anemone de Nancy (the town of the painters); *Flore magno* or *foliaceo*, without petals; White Unique; Variegated Unique (striped); Pompon de Bourgogne; Pompon Blanc (white); Pompon de Bordeaux; Pompon de Kingston.

From the Moss Rose.—Cristata; ordinary Centifolia, white flower; ordinary Centifolia, striped flower; ordinary Centifolia, Sage-leaved; Provence; Unique Zoe; Pompon Moss.

From the Rosier du Roi.—Perpetuelle Bernard; Rosier du Roi (long-stalked variety); Madame Tellier; Mogador; Captain Renard; Cœlina (*sic*) Dubos.

From Rosier de la Reine.—Belle Normande; Madame Cambel d'Isly (*sic*), probably Campbell of Islay, or Triomphe de Valenciennes.

From Duchesse de Cambacérès.—Belle de Printemps.

From Baronne Prévost.—Madame Désirée Giraud; Panachée d'Orléans; Baronne Prévost Marbrée; Madame Lacharme; and one unnamed variety, paler in colour than the type, but not otherwise different.

From Duchesse d'Orléans.—Sœur des Anges.

From Quatre Saisons.—Rosier Thionville, or White Moss Quatre Saisons.

From the Provence.—Pompon St. François; Pompon St. Jacques; Camaïen; Panache, semi-double; Tricolore de Flandre.

From the Damask.—York and Lancaster; variety with bullate leaves.

From the Bengal.—Variety with striped wood.

From Rosa alba.—Variety with Hemp-like leaves.

Among the later examples are the pink Gloire de Dijon, from the common or yellow variety, about which, however, there is still some degree of doubt; Baron Taylor, a pink sport from John Hopper; Pride of Waltham, a salmon-pink sport from the Comtesse of Oxford; William Warden, a pink sport from Madame Clemence Joigneaux; and Mabel Morrisson, Merveille de Lyon, and White Baroness, the latter two certainly, and the former probably, a white sport from the Baroness Rothschild. It seems probable that one of the parents of the Baroness Rothschild was a single or semi-double white Rose, as the whole of the white varieties that have either sported or been raised from it are less double than their parent—losing petals as well as colour in their reversion to more primitive and inferior types. But, however produced, sports are readily fixed and multiplied by the usual processes of propagation.

It would almost seem at times as if these in themselves became means of developing sports. A curious case is recorded by Mr. Henderson, the distinguished American nurseryman, which confirms to some extent this theory. A hundred cuttings of the Tea Rose, La Nankin, were put in, all from the same plant. When the cuttings flowered, four very distinct varieties were developed. One had pure white flowers, others pure pink, a third were pure nankeen, and the fourth were like their parent, white above and nankeen below. Of course colour is more given to sport than any other quality. The old York and Lancaster Rose, for example, often comes with the flakes or bands of white varying in width from a few lines to the overgrowing of the greater portion of the flower. Most of the parti-coloured Roses are also less firmly fixed than the selfs, as if the two or more colours were felt to be a mistake, and they were trying to get back to the state of single blessedness that they had left. The older traditions about Roses would point to red as their primitive colour, and it is probably by a series of bud and seed variations that they have grown into their present state of perfection in regard to form, size, texture, colour, and fragrance. Hence our advice—expect sports,

and when found, not only make a note of them, but fix, and propagate, and so perpetuate them, to the enhancement of your pleasure and the enrichment of your Rose garden.

PROPAGATION BY BUDS.

This is the best method that has yet been devised for the rapid and sure multiplication of existing varieties. Expert grafters may challenge this statement, but they cannot disprove it. True, the percentage of takes in grafting may be as high as the takes in budding. They may reach as high as 95 per cent. in either budding or grafting, though such successes are rare; but then the majority of scions either have or have had at least two, and often more buds; and, therefore, one or more plants in embryo are wasted in most of the modes of grafting in vogue for Roses.

Twofold Character of Propagation by Buds.—It may surprise some who have budded many Roses to hear that, while Roses are taken on by briars or other Roses, the buds may also be rooted into the soil. Budding Roses, however, as generally understood and practised, consists in so fixing the buds of a Rose into another plant, that the former shall form the head, and utilise the root-force or power, of the other. The foster-mother takes the strange bud in or on, and these two become one life or living Rose. Rose-budding is so generally practised and so well understood, that only practical details need be given here, especially as the art of budding in every possible way will be exhaustively treated under PROPAGATION. A brief description, however, and a few diagrams will make the matter clear to the merest tyro in Rose-growing.

Conditions of Success in Budding.—First, as to the stock. It must be a Rose or some plant nearly related to the Rose. All attempts to reach to permanent and lasting success through budding Roses on White-thorns or other plants have failed. Possibly they have been far less tried than the fancies of poets would make us believe. Rose-buds will take freely on all other Roses and briars of all sorts—the Sweet-briar, however, proving a very indifferent stock for any sort of Rose.

State of the Stock.—As free growth in the stock is needful to enable the bark to separate freely from the young wood beneath, it may be called one of the essential mechanical conditions to successful budding. It is probably, however, equally or more important on vital grounds. The moving sap, provided the current is neither too full nor strong, carries healing to the wound, and the healing unites the bud to the stock.

Bud before leafage, and the bud is either washed off, as it is called, drowned out, or decomposed. This is easily proved by experiment. Budding before leaves appear fails as a rule. In the absence of leaves the healing processes are so slow or so completely arrested that the buds are too often left to perish. The selfsame buds inserted by the same agents, in the same way, a few weeks later, succeed. There is a period or stage of growth most favourable to the taking of buds, that is, within a month or six weeks or so after the full development of the leaves. To bud earlier invites failure; to bud much later in a workmanlike manner is impossible. Later on the bark is bound so firmly to the young wood, against its inner surface, that the two become inseparable by any easy or fair means owing to the gradual consolidation of the tissues.

Condition of Buds most Favourable for Propagation.—They should be plump and well matured, rather than merely large. Buds from flowering shoots, rather than from gourmands or rank-growing shoots, should be chosen; round-formed buds are also far preferable to the long ones, however large. These mature buds have a reserve of food and vital force within them, that enables them to bridge over the brief interregnum of isolation before the stock takes them on without serious loss. More than this, they contribute towards the union of themselves with the stock. Meagre buds are like ill-assorted marriages, where the love is all on one side. They are simply taken in or on by the stocks, or they perish. Plump, well-filled buds, on the contrary, contribute their share to the process of union.

Fig. 10.—Rose-branch prepared for Budding, and one Bud Removed.

The buds should be dormant. True, started or growing buds are sometimes used, and if skilfully inserted, and circumstances of weather, &c., are favourable, they take well. But to bud with growing buds is to vastly increase the difficulties of budding, and multiply the chances of failure. Dormant buds, full of vital force and energy, just on the point of starting but yet not growing, are the very best for budding. They should, as far as maturity goes, be in advance of the stock, or behind, according as it is viewed. The current year's wood that furnishes the best buds for budding will, however, as a rule, be more mature

than the wood of briar or Rose, into which the buds are placed.

Finally, the bud itself, and the section of bark attached to it, must separate freely from the wood. Unless this is the case, the base of the bud will be pulled out, and the bark itself also injured in process of separation. Either of these mishaps endangers the prompt and healthy union of the bud to the stock. The two combined may be said to render any union impossible. So much for the general condition of the scion and the stock at budding time.

The condition of the prickles also affords a useful index to the best time to bud. In all cases they are

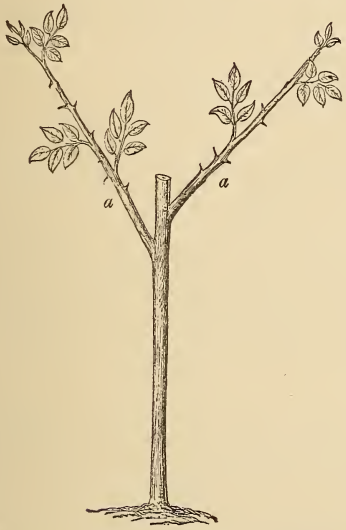


Fig. 11.—Briar with Prickles Rubbed off for Budding.

removed of necessity to enable the bud with its section of bark to be easily slid into the stock, and the best way to remove them is to rub them off sideways with the thumb. If they come off easily, the wood is in a good state for budding; if with difficulty, the most favourable season has already passed.

The Time to Bud.—Taking an average of seasons, the last week of June and the first three weeks in July will be found the very best time for budding. All the more essential conditions already described will be found to be fully developed at this particular season.

Preliminary Preparations.—These are a supply of labels, or numbers, with ties attached for prompt use; a small pan or watering-pot about half full of damp moss; some cotton, worsted, soft bast, or ratafia tie—if either of the latter, the softest and finest to be chosen, cut into lengths of about a foot and tied into a bunch, so as to be hung from a waistcoat-button for this operation—and a sharp budding-knife. That with a round-ended blade at one end, and a sharp wedge-shaped handle at the other, is the best. The use of all these will be obvious as we proceed.

The Actual Removal of the Buds and their Insertion into the Stocks.—Cut a branch, or part of the branch, off the Rose-tree or

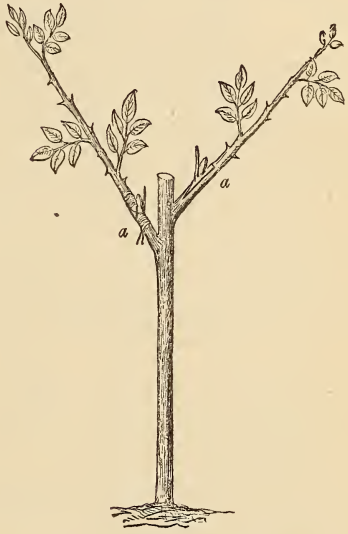


Fig. 12.—The Briar with the Buds Inserted, one Tied in.

bush that is to be thus propagated. It is generally necessary to cut almost the whole of it, as the best buds will mostly be found towards its base. If those nearer the top are not sufficiently developed, cut the shoot back to the last good bud, then carefully rub off the prickles, and cut off the leaves, leaving a small portion of the leaf-stalk intact, and lay it on the damp moss or place it in water (Fig. 10). The same care must be taken of every other shoot, and in fact very few should be taken off at a time, as nothing lessens the chances of success in budding more than cutting numbers of branches at one time, and allowing them to become dried up, or plunging them into water to keep them fresh. Placed *on* rather than *in* damp moss, and covering them with a Cabbage-leaf or cloth, is the surest means of keeping the buds fresh and plump until they are placed in the stocks. Few budders remove the

spines till they are about to remove the buds from the branchlet.

Arrived at the stocks (Figs. 11 and 12), with our dressed branches, rub off the prickles from two inches or so of the base of the shoots of these (Fig. 11), and make a slit with the budding-knife in the centre of the upper side of the shoot about an inch long, being careful not to penetrate deeper than the bark. Most operators also make a cross-cut, which, with the longitudinal one, forms the letter T (Fig. 13). Hence the name of T-budding. The only use of the cross-cut is to facilitate the raising of the bark. It probably hinders rather than facilitates the "taking" of the bud. Taking the branchlet with its buds in the left hand, the lowest bud, with about an inch in length of its wood and bark, is cut out (Figs. 10, 13, 14). The form of cutting and the thickness of section removed are of great practical importance in the art of easy budding, though they may be less vital to the promotion of the union. In no case should the pith be reached or penetrated, about two-thirds of the half-circumference of the shoot being a good medium. Skilful budders, by inserting the knife about half or a quarter of an inch above the bud, reach a maximum depth immediately under the bud, and regain the surface about half an inch beyond it, in this way turning out pointed sections like that given here (Fig. 14), almost as if the knife were a cutting-mould.

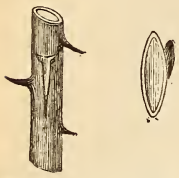


Fig. 13.—Cut in Stock and Bud prepared for Insertion.

Fig. 14.—Bud Detached with Bark.

Those less skilful mostly try to imitate this form by several cuttings and parings with a knife. Unless, however, the section is so large or misshapen as to be unfit to enter the slit, it had better be left as it is, as the first cuts are always the cleanest and the best.

The operator has now the bud detached from the branch, with its section of old wood adhering to the bark (Fig. 14). The next step in ordinary Rose-budding consists in the removal of the wood from the bark. This is the crucial process in the whole operation, and nothing but practice can enable it to be done with safety and dexterity. The simplest way of doing it is that of drawing it out from the bottom. Grasping the bud firmly in the left hand, take the knife in the right, and with its point bend back the bark till the wood is laid hold of between the point of the knife and the finger and thumb, and carefully remove upwards from the base to the point. Some remove it sideways, starting exactly opposite the bud, but the first way is the best. If the base of the bud remains in the section of bark, all is well; but if it projects beyond, into the wood, it will not be likely to grow.

Insertion into the Stock.—There are two general methods of doing this, both of which are perhaps about equally easy and successful. One may be called the horizontal, and the other the vertical mode of insertion. In the former the bud is placed parallel with the slit, the thin edge of the budding-knife being used to raise up one flap at the side, and one edge of the section of bark inserted. The same process is repeated on the other side, and the bud is thus securely inserted in the stock, the bark of which overlaps and almost covers its own bark.

By the other method the bud itself takes a more prominent part in its insertion. The bark is raised in the same way on both sides as before, but just as the knife raises the second side, the sharp point of the base of the bud is inserted at the top of the slit, and follows the knife down to its base, the bud with its section of bark, as it were, ploughing its way to its home in the stock. When any difficulties occur they may, however, be obviated by a little help from finger and thumb, or, in more obstinate cases, by placing the back of the knife across the leaf-stalk, and pressing the bud gently home.

Buds with Section of Wood left under the Bark.—The mode of inserting these does not differ from others, only that they are more easily pushed home, and with less risk of injury either to the bud or the bark, the wood acting as a shield. This method of budding is not, however, to be recommended, unless in cases of necessity, such as in wet and sunless seasons, in which the wood or buds may not become matured enough to permit the buds to stand alone, or the wood to be separated from the bark without ruining the latter. In budding with the wood left in the bark, it may be accepted as an axiom, that the *less* wood the sooner the bud will take, and the more solid and permanent the union will prove.

Position of Buds in the Slits.—The bud should be near to the middle of the space, or a little nearer to the top than the bottom. In all cases where the cross-cut is used, the upper section of bark should abut against it, and be cut so as to fit it perfectly, as the close contact of the bark of bud and stock at that point hastens the completion of the union. So important has the action of this cross-section been thought by some, that its position has been reversed and made at the base instead of the summit of the slit, in order to bring the full force of

the rising sap to bear upon and pass into the bark section of the bud. There is no practical difficulty in placing the bud in the base of the slit and pushing the bud upwards to the top, excepting this, that it is impossible to place it so near to the base of the stock in this way. However, the cross could be made and the bud-bark butted up against it after the bud is inserted. Neither is there any serious objection to cross-cutting the slit alike at top and bottom, so as to have the bud helped to "take" alike by the rising sap from below, and the descending sap from above. This compound T-budding has proved quite successful when tried, and so also has mere slit-budding without any cross-cut at all.

Reversal of the Buds.—This has been thought to give greater vigour to them, and to make them break more strongly. It has, however, been found that buds so placed are more apt to be twisted out by the wind than any others. The buds grow very well upside-down, as there is no anatomical reason to the contrary. But there is no practical advantage in their being turned upside-down.

Tying in the Buds.—This should be done the moment they are inserted, for the greatest enemy to the rapid union of buds and stocks is air, or rather the drying effects of the latter on such delicate tissues. Hence the importance of not exposing the naked internal surface of the bark of the bud, nor the slit or cut in the stock, one moment more than is needful. The air not only wastes the most precious juices of the plant, but dries up and destroys their viscid properties, or those that cement the union between them. Water is almost as repellant a force as air, hence budding should not be carried on in wet weather, nor the buds laid in water, as is often the case. Just as the clean blood is the best healing salve for all wounds amongst animals, so the fresh, sweet, unexposed, unwatered sap is the most powerful of all forces in welding into one any two fractured vegetable tissues.

The tying is therefore simply a mechanical safeguard to keep the bud in position, and not, as many seem to suppose, an active uniting force. It serves a similar purpose to the surgeon's splints on a broken limb, the insuring of complete repose and freedom from movement of any kind. It is important, however, that it should be so firm as to render the parts immovable, yet not so tight as to hinder circulation or wound the bark. Begin at the bottom and pass the ligature three or four times round under the bud, and as many above, and the tie is complete. Expert tiers mostly hold one end of the tie under the branch of the stock, whilst they wind with the other, and thus find the tie-end ready for tying slightly beyond the cross-cut when finished. Some wind closely the whole way, so as to cover every portion of the slit. It matters little so long as the bark is not injured, the bud in the centre left free, and the bud is held immovable till the two tissues are united.

Labelling or numbering should follow close on the heels of budding, as it adds much to our pleasure to see at a glance which sorts take and which may have failed.

Shading the Bud.—This is often done by amateurs, and may help buds to take that have not been inserted in a business-like manner. A little damp moss or a small leaf is the simplest mode of shading. These can be tied on so as to moderate the fierceness of the sun's heat for a day or so. But, generally speaking, shading is unnecessary. In very hot weather it is safest not to bud during the two or three hours on either side of noon; early in the morning, or late in the afternoon and throughout the evening, is the best time to bud, as well for the plants as the operator.

Time of Taking.—This varies considerably according to the weather and other circumstances. Within a fortnight to a month the bud will either have become safely united to the stock or have perished.

Removal of Ties.—This may be done about three weeks after budding. If left too long they often cause much injury to the bark, and irreparable mischief to the bud; almost strangling it by their tightness, and checking or stopping its supplies of food. If the union is perfected, no further ties are needed.

Re-tying.—This is not unfrequently necessary, and it needs experience and a practised eye to know when the union is so complete as to justify the removal of all ties. The wood may have grown so much since budding as to render the removal of the first tie necessary, and yet the wounds not be perfectly healed, or the union be so complete as to need no further binding. When any doubt exists on this point, the safer plan is to give a second tie, leaving it a little looser than the first. This second tie may be removed later in the autumn, or allowed to remain till the spring.

Keeping the Buds Dormant.—It is of almost vital importance that this should be done. Some budders pride themselves on flowering their buds the same season. This may easily be done, but is bad form in budding, and may often weaken and greatly shorten the life of the plant. To have

vigorous plants for life and perfect blooms the following season, it is essential that the buds be kept dormant till the following spring. A good deal depends on the choice of buds. As already observed, plump, round, and quite dormant buds are the best. The early removal of the ties is also an aid to dormancy, as any severe check to the equable growth of the stock, such as that caused by a tight ligature, forces the bud to break. The wilding shoots must also be left full length till the spring. Those who force their buds to break, cut these off three or four inches beyond the bud, about three weeks after budding. By this means growth is partly confined to the bud instead of being carried on through the whole briar-shoots as well, and the

Fig. 15.—Briar Cut Back, and finally Cut further Back to near the Bud at *a*.

bud has the entire autumn, winter, and early spring to fill itself with a maximum amount of vigour and of beauty.

If buds break into shoots soon after budding, on no account must these be allowed to grow or produce flowers. So soon as they have made three or four leaves, pinch off their tops. This course will enable them to form and to ripen several nice buds at their base, and these may break into shoots next season, not greatly inferior in vigour to dormant buds.

Shortening Back the Wild Shoots on Briar or other Stocks.—Towards the end of January, or any time in February, these may be cut back to within about six inches of the buds; one result of this being to keep the newly adherent bud as free from disturbance as possible. Soon after the latter has fairly started—that is, towards the end of April or early in May—the wild shoots may be cut back to the top of the bark-section of the bud (Fig. 15). The cut should be made as short as possible by cutting the shoot almost at right angles. No dressing should be applied, as this only hinders the healing of the wound, and is apt to cause canker and run down the wood, to the weakening or destruction of the bud. This last cut finishes the operation of budding, the stock being now transformed into a Rose-tree (Fig. 15).

Securing the Safety of the First Shoots of the Buds.—This is of the utmost importance, as otherwise all our instructions may end in a fiasco most disheartening to the rosarian. The bud starts with all possible vigour, and shows blooms full of promise. A gust or a strong wind comes, and, lo, the bud and all its appendages are twisted off their stock in a moment, and their fair promise of beauty and sweetness is dashed to the ground. To render such mishaps impossible, at the heading back of the stocks tie one or more stout sticks, a foot or eighteen inches in length, on to the upper portions of their stems, and fasten the branchlets from the buds to these so soon as possible.

When, as on a large scale, this mode of protecting the young shoots is impracticable, further stability may be given to the unity of buds with stocks, and less purchase given to the wind as a twisting-out force, by nipping the points out of the strong bud-shoot so soon as it has made a few leaves. This will force the one shoot to break into three or more, and while it puts back the flowering period considerably, it produces far better and more saleable plants before the end of the year.

From this stage the budded briars are Roses, and must be treated as such. For some time, however, much of the vigour of the plant will try to rush back into briarhood again in the form of suckers, and these, whether springing from root-stem or branchlet, must be promptly and vigorously suppressed.

BUDDING WITHOUT STOCKS.

As each bud is in a degree an independent plant in embryo, it follows that it may be converted into such by artificial means. The art of budding on other plants proves so much; but the proof is still more decisive if buds are rooted in moist soil, sand, or other mediums. And though this mode of propagating Roses is neither so common nor so easy as others, it is nevertheless quite practicable, and possesses the merit which is now more than ever recognised, that of producing rapidly Roses on their own roots.

Size and Form of Bud Cuttings.—These may be larger than those used for inserting in briars, and the section of wood is left intact. The length is immaterial, but the depth of the bud-section should never penetrate the pith; the woody section may also be of about the same depth throughout,

instead of coming to a sharp wedge at either end, as in the case of the ordinary bud. But even this is not essential, and some prefer buds for rooting with the end surface wedge-shaped, the thicker end of the wedges springing from half to three-quarters of an inch below the base of the buds, and tapering to a point half an inch beyond it. A thin paring of bark taken off either side also exposes a large surface of wounded bark or cambium to the contact with the rooting material. This is most important, as it invites a development of callus along both sides as well as both ends of cuttings thus manipulated; and each atom of the callus is capable of emitting roots. Hence buds thus prepared root all round and develop a perfect network of fibrous roots as unlike as well can be to the single or dual whipcord-like samples produced by seedling briars or Roses.

How to Root Rose-buds.—Prepare pots, pans, or a bed as directed in our articles on PROPAGATION. Thorough drainage being provided, pure sand, or some free-rooting material, should be used on the surface, which can hardly be made too hard and firm. Place the buds, prepared as described, on the surface, and press them firmly down, filling up with pure sand until all are covered excepting the upper surface of the bud-section, and the bud in the centre of it. Water freely, and just before the water disappears, gently tap the pot or pan on the bench to consolidate buds and surface soil more perfectly. Of course this cannot be done where the buds are planted in beds. In placing the buds leave at least an inch of clear space between any two buds at all points. This will be wanted to give room for the curious and most necessary development technically known as "callus." This is produced along the ends of the bud-section, between the bark and wood, and also along the sides of the bark. It is neither stem nor root, but something between the two, and the source from which all roots proceed. So soon as it is thoroughly developed the bud is safe, and will, under fair treatment, form roots all round the sides and ends of its outer extremities; so that rooted buds are furnished with a perfect network of fibres at all points, and these of the best possible quality for feeding purposes.

If the bud starts into growth before this happens, it soon empties itself and the section of wood and bark around it of all the food which they contain, and it quickly perishes. On the contrary, if the buds remain dormant till the callus is formed, the sooner the buds break into leafage afterwards the sooner will roots be produced. The demands of the expanding leaves for more food quicken the development of roots by the callus. The simplest and best means of effecting these dual benefits is by keeping the tops very cool, say in a temperature of 40° to 45°, and placing the buds in a bottom heat ten or fifteen degrees in advance of the top. So soon as the bud-section's callus and roots begin to be formed, the tops may be pushed on in the same temperature as the roots. For after this stage the faster the tops grow the faster also the roots, and the two keep up a neck-and-neck race in the building up of a vigorous Rose-plant.

Potting off.—So soon as the plants are fairly rooted they should be potted off singly, and kept in close and genial quarters till established. They may then either be grown into plants in the green-house, close pit, or frames, or planted out of doors, so soon as they are gradually hardened off; and finally planted out of doors in the autumn.

Some cover Rose-buds from the first with a bell-glass, and subject them to a high temperature and a semi-saturated atmosphere. But this course is seldom successful, while that last described seldom or never fails.

COMMON GARDEN FLOWERS.

ADONIS AND CANDYTUFT.

The Adonis is one of the smallest families in the great and beautiful order, *Ranunculaceæ;* and the two perennial species, *vernalis* and *Pyrenaica*, used to be common plants in most old-fashioned gardens. *Adonis vernalis* is one of the earliest as well as most showy flowers of the early spring, blooming in early seasons in March, and in ordinary ones early in April. It rises to a foot or more in height, and the rich golden crops of flowers look all the more rich and striking as they stand up on the elegantly-cut sessile foliage, somewhat resembling that of a very light green carrot at a distance. It is perfectly hardy, as its native home is contiguous to the snow-line on the European Alps; and hardly have the snows passed away when the Spring Adonis springs forth and blooms, covering, where it abounds, the mountains with gold, and affords a brilliant contrast to the vernal blue gentians that carpet the base-lines of the Adonis. Though it thrives on snow-water, with its roots running in the well-drained *débris* of the residuum of rocky waste, yet few plants are more sensitive to cold soils or wet bottoms than the vernal Adonis. Under such untoward conditions the light green of the leaves becomes almost yellow, and the crop of fine cups that crowns them with beauty disappears.

The best place for these plants is a warm nook or corner in a cosy old-fashioned kitchen or other

garden. The soil may be moderately rich, it must be dry and warm and rather light, to grow these pretty old-fashioned flowers to perfection. The *A. vernalis* is the best species, *A. Pyrenaica* grows rather taller, but is not so good. It, however, is useful for a successor, as it seldom blooms till June or even July.

Several other species are found in botanical works, and may occasionally be met with in botanic gardens, such as *A. Apennina*, *A. Davurica*, and *A. Siberica*. The latter is as big again as *vernalis*, but in no respect better, and the whole of the perennial varieties are almost the same shade of colour.

These plants are not very rapidly increased, as they only ripen seeds under very favourable conditions, and the seedlings are several seasons in growing into flowering size. The only other method of propagation is by root division, and the plants are somewhat impatient of disturbance. Generally, the finest patches of Adonis have been those that have been left undisturbed for many years, or received a top-dressing of light rich compost annually. The best time for applying this is in the autumn, as it has thus the whole winter before it, to strengthen the roots, and add to the number and augment the size of the flower, which not seldom exceeds from two and a half to three inches in diameter. This plant, like most of the Crowfoots, enjoys deep root-runs, provided they are fairly dry, and hence crevices in rock-work, with nests of promising soil, suit the Adonis well. The light sessile foliage also harmonises with Ferns well, while the brilliant golden flowers form an admirable contrast to tufts of Forget-me-nots and Aubrietias.

In addition to these perennial varieties there are several annual ones. Amongst these the *autumnalis*, *æstivalis*, and *flava* are the best. The first is a brilliant hardy annual, a native of Britain, often found in corn-fields, but worthy of a place in the flower-bed or border. It is of a bright crimson colour, and may be had in flower throughout the summer and autumn, and is popularly known as the Pheasant-eye Adonis. The second, one of the tallest of all the Adonises, of a bright scarlet colour, is a native of the South of Europe, and flowers in June or July. The last is more dwarf, and is of a yellow colour, and is more like the perennial species.

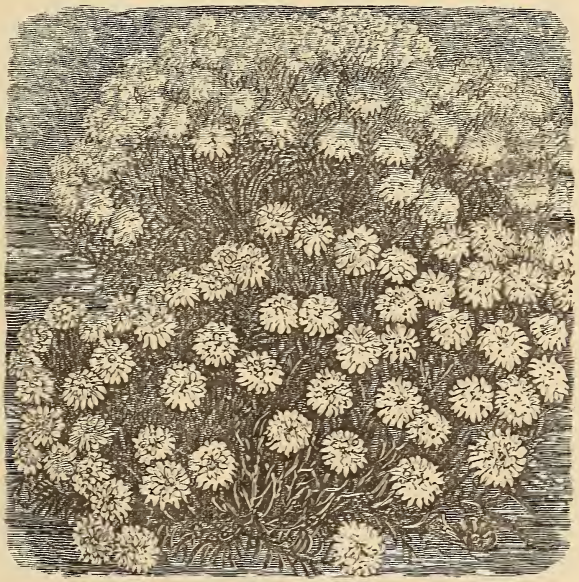
Seeds of these annual species may be sown at different seasons, from February to May, and thus a supply of these pretty old-fashioned flowers be kept up from April to November. The name Adonis is said to be derived from the classical myth, that this plant sprang forth from the blood of Adonis when wounded by the boar, the allusion being obviously to the brilliant-coloured annuals and not to the yellow perennial species. However, the Anemone is the rival of the Adonis, in claiming its origin from the same source; and with all due respect for the brilliance and beauty of some of the latter, they are no match for the extreme brilliancy of the scarlet and other Wind-flowers. Possibly the name was derived from the early flowering of the *Adonis vernalis*, as a spring festival was held in honour of Adonis, when an image was buried with imposing rites and ceremonies, perfumes were burned, and Violets and other early flowers, probably *Adonis vernalis*, were strewn over the grave.

ADONIS VERNALIS.

Iberis, or Candytuft.—Both the botanical and common names of these plants are derived from the countries whence they were introduced—Iberis, from Iberia, the ancient name of Spain, and Candytuft from Candia, from which *I. umbellata* was introduced in 1596; and the last and most useful of all the evergreen, shrubby Candytufts, *I. sempervirens*, was brought in 1731. Though thus hailing from the southern parts of Europe, most of the Candytufts are sufficiently hardy to withstand our ordinary winters, and they have long been among the most popular and

universally-grown plants in our gardens. Even the annual species are very frequently sown in the open in the autumn, pass safely through the winter, and thus treated bloom very early in spring. They are not, however, all alike hardy. Among those of dwarf shrubby evergreen character, perhaps *Gibraltarica* and *semperflorens*, the latter a native of Sicily, are the most tender. Even these, however, do well in the South and West of England.

But, without doubt, *Iberis sempervirens*, or the Common Evergreen Candytuft, is by far the best and most popular of all the species. It is found in almost every garden, and in very many is the only one seen or known. Neither do those who adhere to this species lose much by doing so. It is seldom or never injured or destroyed by the weather, and grows with great rapidity, forming a dense evergreen mass from six to nine inches high, and from twelve to eighteen, or even twenty-four inches across. In farm and cottage gardens even larger patches may be met with, and hardly any plant can be more effective in its snowy whiteness from April to June. Single plants on sloping banks, or posted here and there on rooteries, rock-work, or ferneries, are the most effective. This fine Candytuft looks well by itself, or contrasted with the early Forget-me-not or Aubrietias. From the density of its habit, and the neat evergreen character of its leaves, this Candytuft is admirably adapted for edgings for small beds, either on gravel or as a secondary edging within a few inches of the turf. It grows with almost equal freedom in any soil, provided it is neither too wet nor too strong. The free, open, airy places suit all the Candytufts best, and the more freely they are exposed to sunshine the more profusely they bloom. Wherever beauty or purity is needed to light up dulness, counteract the sombre effects of excessive verdure, or soften and mellow down quaint or grotesque outlines, the Evergreen Candytuft may be freely planted.



CANDYTUFT (IBERIS SEMPERVIRENS).

Among other species or varieties well worthy of cultivation, the following are the best:—

I. correæfolia, or Correa-leaved Candytuft. This is one of the largest-flowering and most distinct of the whole family, and is often confounded with two other species, neither of which is equal to it.

The first of these is *I. corifolia*, a much smaller sort, and probably only a smaller variety of the Evergreen Candytuft already described. The other is *I. Gibraltarica*, which considerably resembles the Correa-leaved Candytuft, but has smaller flowers, and is less hardy than this species. *I. correæfolia* has large leaves and large corymbs of fine white flowers standing boldly up close to the leaves. It is also among the later-flowering of all the Candytufts, seldom blooming until most of the others are going off, that is, about the first week in June. This forms a fine companion plant to the Evergreen Candytuft.

I. saxatilis, or Rock Candytuft, is one of the most hardy and useful, and grows to a height of from six to nine inches.

I. pubescens is comparatively rare, and differs considerably in habit and foliage, but more in the colour of the flowers, from any of the foregoing. These are of a pale violet colour, a colour more fully developed in the next species.

I. Tenoreana, or Tenore's Candytuft, is a pretty and distinct evergreen herbaceous plant, about six inches high, flowering in June and July, the colour of the flowers being a sort of French white deepening into pink or puce. This species, however, lacks the vigour and robustness of constitution of those already described, and seldom thrives well unless in a light soil, and on a warm site.

I. linifolia, or Flax-leaved Candytuft, is another puce-coloured herbaceous Candytuft, about eighteen inches high.

I. Taurica, or Taurean Candytuft, is another dwarf white herbaceous sort worth growing.

In addition to these shrubby and herbaceous Candy-

tufts, there are several annual species and varieties very generally grown in gardens. These annual Candytufts have also been greatly improved of late years. The sweet-scented, however, or *Iberis odorata*, still holds the most prominent place. The old *purpurea* is also extensively grown, though the crimson and carmine strains have largely superseded the older purple Candytuft. The white Rocket and white Spiral are marvellous improvements on the older varieties, while the white and rose dwarf, or Tom Thumb, form dense masses of rich and rare beauty, far exceeding any of the older Candytufts, annual or otherwise.

These fine annual Candytufts possess the merit of being almost as hardy as the shrubby or perennial herbaceous ones. They may also be had in flower throughout the greater part of the season by simply sowing them in succession from September to June. The seeds should be sown thinly on rather poor soil, in a sheltered spot, in the autumn, and again in February and May, when annual Candytufts are wanted to keep up a succession of their beautiful and useful flowers throughout the season.

The shrubby and evergreen herbaceous Candytufts, such as *sempervirens* and *Tenoreana*, may also be propagated by seeds sown in the open, either so soon as ripe or in February or March. But these are more generally increased by cutting or division.

The best time for rooting the cuttings is about a fortnight or three weeks after blooming. Remove the young shoots with a heel, and dibble them in thickly under a cloche or hand-light, in sandy soil, and slightly shade from bright sunshine till rooted. Gradually expose to light and air, and plant out in flowering quarters, so as to have them fully established before winter. Those who have no glass may root Candytuft cuttings on a shady border without it. In that case the cuttings should be a little older and firmer before insertion, and the process of rooting will be slower. It will also be needful to frequently sprinkle the cuttings overhead, as well as shade them from direct sunshine.

Root or stool division is not so suitable for the propagation of Candytufts as for Alyssums, Aubrietias, and many other plants. They are far more prone to run up with a single or a few stems than those similar plants; and old plants of Candytufts flower more freely than younger ones. Hence it is not wise to disturb or divide them too often for purposes of propagation. Nor is it needful in situations where the shrubby Candytufts ripen seeds. Besides, plenty of cuttings may always be obtained, and when these are thinned out with knowledge and discretion, an abundance may be obtained for propagating purposes without greatly lessening the amount of bloom on the old plants.

What with the more permanent species and varieties of shrubby and herbaceous, and the improved quality and greatly augmented numbers of annual Candytufts, a garden might be kept fairly well furnished with these alone throughout the year, at less cost and less trouble than with any other plant. Candytufts are also so tenacious of life, so easily suited with soil and other conditions, and seed so freely, that when once introduced into a garden, they mostly reproduce themselves without much further care or trouble, and hence, to a great extent, they are perhaps the most common of all common flowers.

GARDEN WALKS AND ROADS.

GARDEN WALKS.

IN a flower garden no walk should be narrower than three feet, as two cannot walk comfortably abreast on a narrower space. Beyond this, their breadth should be mainly determined by the wants and tastes of the proprietor, the size of the demesne, &c. In the majority of gardens and pleasure-grounds the walks are too narrow; in very few are they too wide. A distinction should also be drawn between walks for pleasure and those for mere utility. Flower garden and pleasure-ground walks are of the former class, those in the kitchen garden of the latter; and as long as these are of sufficient width to allow of two barrows passing, they serve every useful purpose. But very often the kitchen and fruit gardens are as much used as a promenade by the family as any other part of the demesne, and in such the width of the walks must be determined by similar considerations.

Hence, in not a few gardens the walks are of a uniform width throughout. This imparts a noble, enjoyable, and easily accessible character to a place, which is seldom the least of its charms.

No garden can appear neat and pleasurable where trim walks, clean and neatly kept, do not exist. Beyond doubt, gravel walks are most to be commended, though asphalt, cinder, grass, &c., often exist. The former is, however, liable to injury by frost and the use of the wheelbarrow; the second looks poor, and the third is not desirable during rainy weather, to say nothing of the labour it entails in mowing, and want of firmness generally. The base of a gravel walk should consist of rough brickbats or stones to half its depth, rough gravel for making it up to the needful level, with a coat of hoggin, or finely-sifted gravel, for the surface. From three to four feet are good widths for them, and they are mostly carried round the garden at distances of from six to nine feet from the walls;

two or more walks of the same width, intersecting the garden in the middle, thus cutting it into four equal quarters. This is one of the most convenient arrangements for cultural purposes, and with a fountain, Rose-arbour, covered seat, statue, vase, or other centre-piece in the middle of the garden, it also looks well and appropriate.

Kitchen Garden Walks.—These being chiefly for utility, hardly any of the foregoing principles apply to them. As a rule they will follow the line of wall or other boundary fence, and they will also generally proceed from each other at right angles, as the ground is mostly some form of square in these. Kitchen garden ground being more valuable than that in either the flower garden or pleasure-grounds, the walks may, as a rule, be somewhat narrower. Any attempts that have been made to carry a winding walk to any good purpose through a square or parallelogram devoted to vegetable culture have signally failed.

Working Walks or Alleys.—More or less of these are generally associated with, and run parallel to, the main walks in kitchen gardens. These vary in width from six inches to eighteen, and are simply working paths for men and barrows. They are generally formed of earth only, or surfaced, for greater cleanliness, with ashes, sawdust, spent tan, or cocoa-fibre refuse. Some of them by the sides of fruit borders become semi-permanent paths; others are dug in and re-made for convenience annually, or oftener, as the cropping proceeds. The space is simply set out, and two inches or so of the soil taken out with the spade and laid on either side. This is trodden down, raked, and beaten level with the back of the spade, and the sides cut down straight or at an angle. The bottom is then raked smooth, and the alley of the latter class is finished; or the base may be surfaced with any of the materials already named, or sand, ballast, or burnt earth, where these abound near the spot. Others take even less trouble, merely lining out and trampling down the vacant space, and leaving it so. But good alleys are well worth the trouble they take in making, as affording ready and cleanly access to garden products in all weathers, and also for the neat and cared-for appearance they impart to the garden.

These alleys and indeed, all the walks in the kitchen garden, were often formed of grass in the olden times. If well kept, these are most cleanly and enjoyable in dry weather; but they are very much the reverse during rain and snow, and dirty weather in general. They were also expensive to keep, and furnished harbours of refuge and the best of feeding-grounds for worms, slugs, and other garden pests. Hence the general abolition of grass walks or alleys in kitchen gardens.

Abolition of Walks in Kitchen Gardens.—The labour of keeping, the risk of injury to the roots of important valuable crops, and the waste of space caused by walks, are so very considerable that some have proposed to dispense with them altogether in the vegetable and fruit gardens. In cases where the vegetable garden is large and at a considerable distance from the house, and thus is quite separated from the general pleasure-grounds, there seems little more urgent reason why it should be intersected with walks than fields devoted to root or even corn crops. Mere earth paths or roadways where the ground is dry may suffice for the cartage of manure on to the ground or of produce off it. Where the ground is too heavy or tenacious for such pathways to continue passable in wet weather, a layer, six inches or so in thickness, of burnt clay, marl, or other earth, cinder-ashes, slack, or other hard material, will make a fairly clean roadway or path in almost any weather. Even a few inches of sawdust, spent tan, or cocoa-fibre refuse, have the merit of making a fairly clean pathway over the surface in the dirtiest weather.

Commoner and Cheaper Walks.—Cinder-ashes, with a little unslaked lime; chalk, builders' rubbish, and grey lime; gravel, with a dash of lime and cement; and many sorts of burnt earth or ballast, either with or without any addition of cement, lime, or tar, carefully spread over the surface to the depth of a few inches, will make a temporary path that will answer in many places for years without much more trouble and expense. In all cases of making surface walks of this sort, the ground should be levelled and rammed hard at first, to insure the walk material, whatever it is, being of an uniform thickness throughout. Spread it evenly, roll it down firmly, and surface, if possible, with an inch or two of good gravel. On dry ground, surface walks of this sort are not seldom good enough for kitchen gardens. Of course, the smaller the garden, the narrower the walks—as a rule; and though wide walks have been strongly advocated alike for comfort and effect in these chapters, yet a walk a foot or eighteen inches wide, well made, and passable in all weathers, is really far more satisfactory than a six-feet walk that is transformed into bird-lime through very heavy rain.

A yet more simple path may be made on dry soil by simply raising it up well above the level with the earth on the spot and on either side of it, forming the crown of the path almost in the shape of a semi-

circle. Tread, ram, and roll the earth down solidly; sprinkle with coal-ashes, gravel, burnt earth, or other non-adhesive, if available; and such raised gangway will afford a cleanly passage to and fro for years. In any case, walks in kitchen or fruit gardens need not be made so deep as in the flower garden or pleasure-grounds. On most soils a depth of from four to six inches would prove sufficient, and if placed, as they often are, within six feet or so of walls clothed with fruit-trees, the fruit border may be continued under the walk, and the walk made or laid carefully over 't. This may seem difficult on paper, but it is simple enough in practice, and answers well; the roots, as already stated, crowding under the walk more thickly than in the borders specially devoted to them. But this is treading on cultural grounds, though hardly out of place here, as in the garden structural and cultural matters are constantly running into or overlapping one another.

MAINTENANCE OF ROADS AND WALKS.

Never was the adage "A stitch in time saves nine" —or nine hundred for that matter—more literally true than in regard to the keeping of roads and walks in creditable condition. On roads especially, the first rut, if ever so small, should be at once filled up. If not, each rut helps every passing foot or wheel to dig it out deeper and yet deeper. This must be so obvious to all as to need no further insistance upon or illustration, and yet practically few responsible for the maintenance of roads act as if it were true. They are seldom repaired before they are virtually ruined, and hence road-repairs are perhaps the most unsatisfactory of all the many reckless investments that abound in this age of daring ventures and more haste than prudence. The proverbial folly of locking the stable after the horse is stolen is wisdom itself compared to the folly of deferring road-repairs till too late. In the one case only one horse is lost; but here road, labour, horse-power, harness, time, and money are all thrown into a veritable bog or road without a bottom, and neither profit, pleasure, nor wisdom seems to follow in the wake of all these losses.

Prompt repairs with the very best materials, is the secret of the maintenance of roads in good condition. Any compound of abominable rubbish is often accounted good enough for the repair of roads. They may or may not have been well made; but here is a hole, and builders' rubbish, stone, flint, or half a brick, or a load of these, is hurled headlong into it. Such recklessness is not only foolish, it is almost criminal, inasmuch as it not only destroys property, but endangers life. It is hardly too much to affirm that nine-tenths of road accidents arise from the imperfect construction and faulty repairs of roads. The majority of farm roads are in the most disgraceful state, in regard to both. But not a few gardens, and even carriage and public roads, are very far from what they ought to be, alike in construction and repair.

A very little good granite or other hard stone or gravel, applied in the right time, place, and manner, proves far more effective than tons upon tons misapplied. Besides, very often little or no new material is needed. The traffic has caused a misplacement only, and all that is needful is to place the road material back from whence it came, and ram or roll it down.

Weeds.—Weeds left to themselves are wellnigh as destructive to roads and walks as ruts or other destructive agents or causes. The roots loosen and disintegrate the hard materials, and the decomposition of roots and tops alike gradually transforms these into mould, or covers them with a débris that is still more favourable to the development of yet more weeds. Besides, weeds mar the beauty of roads, and though they may not greatly hinder locomotion, they spoil the pleasure either of riding or of walking upon them. Prompt suppression or eradication, therefore, becomes a matter of the highest importance.

Good making with cleanly and hard materials prevents the growth of weeds, while prevention is not only much better but infinitely cheaper than cure. Asphalt and concrete roads have this great advantage over those formed of stone and gravel—they are weedless. But on all other roads and walks the pest of weeds must be met and mastered as best it may. Frequent hoeings and scarifyings are the most frequent means employed to keep down weeds; but they have several serious drawbacks. They destroy the hardness and smoothness of the surface for the time being, and the loose granite forms a capital seed-bed for the seed of weeds, with which the air is fully stocked. Both these evils may be partially neutralised by heavy rollings.

But on the best roads and walks these methods of eradicating weeds are rendered impracticable from the hardness of their surface—hence, partially, and also on the ground of economy, the practices of pickling, poisoning, and scalding the weeds of the surface of roads and walks. All these processes have the immense advantage of not breaking up the surface; they involve little labour, and act almost at once.

Perhaps pickling the weeds to death with dry salt is really one of the simplest and most efficient of all these methods. The salt should first be run through

a fine sieve, rubbing all the lumps through. Thus prepared, it not only goes almost as far again, but can be far more regularly distributed, two or three tons sufficing for the walks of a good-sized demesne. Applied in sunny weather if possible, and about the thickness of a mere shower of snow, that half covers, half reveals the surface, it proves very effective.

To economise the salt and make its action more rapid and effectual, the late Mr. Fleming, of Trentham, invented a salting machine, consisting of a furnace, a copper, and a distributor, on wheels, which poured a fine shower of boiling brine on to the weeds, and made an end of them at once. The liquid was, however, apt at times to be blown on to the grass or edgings by the sides of walks or roads, and of course destroyed both. As a set-off against this, however, it must be stated that while dry salt lies on walks or roads, every wheel or foot leaving the gravel or stone for the turf carries disfigurement or death with it, until the adhering salt is all dissolved and absorbed.

The salting machines were so efficient and rapid in their action that some left out the salt, and converted them into mere scalding machines, from which boiling water was showered upon the weeds, with almost equally destructive effects; and thus the chief objection against salt—namely, that though at first destructive it ultimately becomes a stimulating manure —was got rid of. There is no doubt of its killing power, but it is equally evident that on certain soils, and in certain states of weather, fresh weeds spring up rapidly on the heels of the salting process. Still, the plan is on the whole so cheap and efficient that the pickling of weeds off roads and walks is very generally practised. Our own plan for years has consisted in one light dressing of salt, and another of gravel, but little thicker than the salt, annually; the former keeps down weeds, and the latter, combined with a secondary quality of the salt, imparts that brightness and semi-sparkling brilliancy of colouring which constitutes one of the chief charms of walks and roads.

The pickling processes are almost as efficient against worms and slugs as for killing weeds, and, combined with frequent and heavy rollings, and an occasional sweeping when necessary, maintain stone or gravel surfaces in first-rate condition.

For the poisoning of weeds ammoniacal gas-liquor, weak solutions of sulphuric acid, and paraffine or other mineral oils, have been used. None of these, however, are so simple, cheap, safe, or efficient as salt, and they can hardly be recommended for general use.

One of the simplest aids to the good keeping of roads and walks is their constant use, and the using of the entire surface to the same extent. So much is this recognised in Scotland, where many of the finest roads are to be found, that lengths of trees, three or four feet long, mounted at one end on two legs a foot or so in length, are used in quantities to force the traffic into fresh channels every day. These are placed on at daylight, and removed before dark; and no expenditure in keeping roads pays better.

With a little attention to this regular distribution of traffic over the entire area of walks, it would be found that few or no weeds would grow upon them. Finally, the more traffic and the oftener rolled the easier are they kept clean, as solidity is a powerful element in the good maintenance and preservation of a cleanly surface on either roads or walks.

GRASS WALKS, ROADS, AND RIDES.

Grass Walks. — These are still among the most enjoyable features of many of our best gardens. In order to wear well, and prove really enjoyable, they should be thoroughly drained and well made, for similar reasons to those insisted upon in regard to ordinary walks and roads. Wet turf wears through with the slightest friction; comparatively dry, it will bear any amount of friction from pedestrians, and even a great deal of light carriage traffic, without injury. Uniformity of depth and of quality of soil are also of vital importance to the development and maintenance of the highest qualities in grass walks and promenades. Where these have not been provided the grass wears into patches, and also grows in a similar way to its utter disfigurement and ruin as a perfect and pleasant walk. Fat turf here, lean there, none yonder—these are the penalties exacted from scamping the work of due and careful preparation of base and soil for grass walks.

Where these walks are bounded with trees, for the forming of avenues, even greater preparation is needful; for the overshadowing of the trees as they grow up proves a powerful hindrance to the proper growth and maintenance of grass walks and rides. But, with a sufficient depth of soil of uniform quality throughout, this difficulty may be lessened very much, if not wholly overcome, and the grass promenade or walk maintained in that elastic condition and with that soft semi-velvety surface that indicate perfection in a turf walk or avenue.

On estates of any considerable extent, especially in the North of England and Scotland, these form one of the most delightful features of numerous domains. They vary in width from ten to twenty feet, and are swept through woods and plantations in bold sweeps and meandering curves. Straight rides, half a mile or a mile in length, are also sometimes formed, and have a rich and telling effect when carried through trees of large growth that, whether

planted in regular lines or not, yet have most of the noble effects of fine avenues. But most of the rides are so wound and curved through the woods as to bring out all the richest features of the woods, plantations, and near or distant scenery. Now the ride skirts the boundary of the wood, and anon it plunges into the dense shade or deep gloom of a Scotch Pine forest, fifty, a hundred, two hundred years old. Again, it passes through a forest of Oak, to be succeeded by one of Larch, Birch, or Beech. A commanding plateau is reached, which affords a broad view of grass and corn fields, sandwiching each other with green and gold far as the eye can reach; and soon after the ride plunges down a steep hill till the deafening roar of a broad river is heard, and its rapid-running waters are seen to foam and dash over its rough bed of boulders. On some estates known to us in Perthshire the grass-rides exceed an aggregate of twenty miles.

For rides on horseback, drives in pony-phaetons and carriages, there are no walks or roads so charming as grass-rides. Properly made and kept, they are always accessible and fit for use, unless in the very worst weather.

On light dry soils—and such are the majority of those on which woods are planted—all that is needful is to stake out the ground, level it throughout, cut an open ditch on either side to the depth of a foot or eighteen inches, sow choice grass-seeds in April at the rate of 50lbs. per acre, roll heavily at times till the grass gets well established, and mow once or twice or more a year ever afterwards, with occasional rolling should the surface get loose, and top-dressing should the grass get poor. The rides will grow apace and remain in first-rate condition. Or the rides may be formed at once by laying them down with turves, a yard long, a foot wide, and an inch thick. Ram and roll these home, and the ride will be fit for use a few months after making.

Through wet woods or plantations the ride should be raised six inches or a foot above the surrounding level; brushwood, tile, or stone drains should be run into the ditches on either side; the earth thoroughly consolidated; the ride sown with seeds or roughly laid with turf, such as may generally be found on the spot, and treated as the others on light soil.

On most estates the crop of hay off the grass rides pays for their keeping. The making of rides costs but little, as the work is done in winter, when labour is plentiful; and the pleasure derived from a gallop or drive over elastic turf, in select company, through the richest arboreal sylvan scenery, is simply inexpressible. The sanitary advantages of rides as exercising-grounds for children and adults probably more than match their many features of interest and beauty.

Good making, as in the matter of stone and gravel walks and roads, is the better half of perfect keeping. Still, as grass grows, and dead road materials do not (always excepting weeds, however), of course their modes of keeping are widely different. The key to the perfect keeping of grass walks consists in their perpetual cutting or mowing and frequent rolling. Solidity of base and substance and a short surface, are the surest means of making and keeping turf walks or lawns in perfect condition. The closer and oftener, in reason, the grass is shorn, the faster it grows and the more the stems ramify in a horizontal direction. It is these under side-growths that impart durability and elasticity to grass walks and promenades.

Now that we cut and roll simultaneously, and with a rapidity impossible and undreamt of by the best scythemen, there is no longer any excuse for that indifferent keeping of grass walks which robs them of full half their charm. The work is also much better as well as more quickly done, a weekly mowing being all that is needed to keep grass promenades in perfect order.

It may also be needful occasionally to water them during parching droughts; but watering is rather an exceptional means of culture than a factor to be taken into serious account in the ordinary keeping of grass walks or avenues.

Of course, too, in the autumn and winter, when mowing may not be necessary, the broom, rake, or sweeping-machine will be used to remove all dirt, débris, worm-casts, and fallen leaves, as either of these, allowed to accumulate on the surface, not only destroy the beauty, but also injure or destroy the grass.

Top-dressing of Grass Walks.—Of all the slovenly receipts for the purpose of renewing or maintaining the vigour and verdure of these, that of leaving the grass mown off on the surface is the worst. This modern method is as slovenly as it is inefficient. When well made and properly kept, grass walks will last for years without any dressing whatever. And when they show signs of exhaustion, a surface sprinkling of rich compost, half an inch or so thick, applied in November, and raked in, is the best possible stimulator of weakly-growing grass; or the dressing may be applied in March or April, and, if the grass seems thin, a fair sprinkling of the finer lawn grass-seeds raked and rolled in with the dressing. Where such dressings are objected to, a sprinkling of guano or carbonate of soda applied in showery weather revives the drooping grasses at once to their pristine vigour, verdure, and beauty.

When such means of restoration have been

neglected, and the grass walk has fallen, metaphorically, into ruts and muddiness, the simplest as well as the only radical cure is to lift the turf, in October or November, see to the repair and unblocking of the drains if need be, re-level the ground if it has subsided into irregularity of surface, add an inch or two of fresh compost, and re-lay the turf. The effect is almost magical; even the simple processes of re-levelling the ground and fresh laying the turf being generally sufficient without the extra aid of top-dressings. In cases where the old turf will not suffice to cover the new surface, the deficiency may be made up from the nearest common or roadside; or the existing turf may be torn, not cut, into pieces ten inches across, and laid down roughly, so as to regularly cover the space, leaving about equal interstices between. If evenly rammed or rolled in, so that the pieces of turf almost disappear, they will spread so rapidly horizontally as speedily to cover the entire surface and make a good grass walk for years. This process—technically called "inoculation"—will be again adverted to when we come to treat upon grass lawns, as, where these are made or improved on a wide scale, it proves an immense saving of turf, labour, and consequent expense.

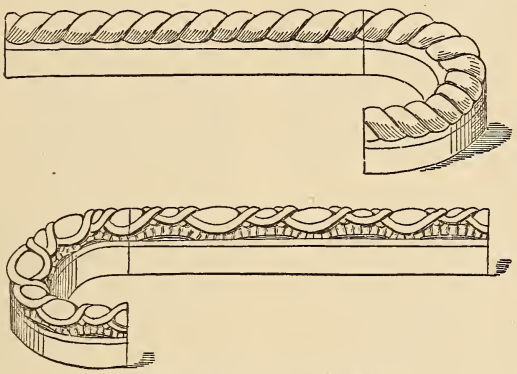


Fig. 5.—Terra-cotta Edgings.

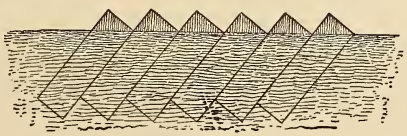


Fig. 6.—Brick Edging.

EDGINGS FOR GARDEN WALKS.

In pleasure-grounds and flower gardens nothing equals turf. In kitchen gardens nothing can match ornamental tiles, stone, cement or compost, terra-cotta, cast-iron, slate, or glass; all these can now be had, of chaste patterns and at a cheap rate, and they leave little to be desired in the way of cleanly, ornamental, durable, and efficient walk edgings (Fig. 5). Flints from chalk strata, pebbles from the seashore, shells, bricks, and clinkers are also often used for edgings. Common bricks, or white Suffolk bricks (costing about £4 per thousand), laid end to end with one of the four square edges uppermost, have a neat appearance, and lie tightly when the edges are laid evenly against each other from end to end. The white Suffolk are hard and cheerful. The common red become somewhat green with age, and as they show only an angular edge above ground, are not distasteful. Both their utility and appearance may be greatly aided, however, by giving them one or two coats of liquid cement; and to suit individual tastes this latter may be coloured somewhat if needful, though the stone tint of the cement is perhaps more desirable than any other. One other form of edging is commendable. It consists of the extremely hard and endurable kind of minor brick known as "clinker," generally used for stable floors, consisting of long narrow shape, roughly formed and burnt. They prove, when laid sloping one against the other, with only an angle of a corner of each above ground, very neat, and of a pleasing rustic appearance (Fig. 6). Fixed firmly together, these also are not easily disturbed. With the soil firmly attached upon the walk side, forking the border on the inner side can be fully performed without moving them.

Living Edgings.—Among these, Box is still the most popular and most suitable. It is also one of the oldest garden edgings in existence. It has been so long in use for this purpose, and so vigorously suppressed, as to have attained to a lowness of stature that has become a second nature to this particular variety. Dwarf, dense, and green, it is the beau-ideal of a living walk edging. Well laid on a solid base of hard soil, and only permitted to grow to two or, at the most, three inches high, and from an inch to two through, it is at once neat and efficient. It becomes objectionable when allowed to grow out of form into excessive bulk. The roots then draw the goodness from other crops, and the tops afford shelter and breeding-places for slugs and other vermin. Clipped twice a year, in April and July, and cut into the form of a sharp-pointed wedge, few edgings look better than a neatly-cut line of living Box as a dividing line between the earth and the gravel.

Box edgings are easily laid. Previous to finish-

ing gravelling, a ridge of soil is placed along both sides of each walk to line and measurement, so as to form its exact site. Such soil, having a line stretched tightly over it from end to end, is beaten down firmly and evenly upon its surface to a level with the mean level of the borders. With the spade a trench is chopped out along the line, perfectly straight on the side next the walk. The Box, pulled into uniform sizes of about five inches each, with roots attached, is subsequently placed firmly in such trench, with about an inch of its apices only above the ground-level. It is then buried with the soil removed when forming the trench, being well trodden in and made firm, when gravel is placed against it, and the laying of the edging and the surfacing of the walks are thus completed.

Box edgings will last indefinitely when annually clipped closely during the month of June. But although when well laid they may be almost looked upon as permanent, yet they generally thrive best when renewed at intervals of, say, from three to five years; the constant cutting is apt to produce a stunted and thickened condition of root, which is best counteracted by division. When the Box is re-laid, as above described, all the inferior and surplus stock should be laid in up to within an inch of its top in good ground. The plants will root right up to the limits of their buried portion, and this reserve should be freely drawn upon at each fresh re-laying of the edgings. Where the edgings have become at all old or unhealthy, these also should be torn to pieces in small portions, and laid in the reserve ground for Box, and the fresh edgings entirely formed from the reserve ground.

Box will not thrive upon wet or very heavy ground, and on such either dead edgings should be used, or some lighter soil employed for the growth of the Box. The latter thrives well in the black, rather rich mould, mostly found in old kitchen gardens. Care must also be taken not to wheel nor walk over Box edgings, as, though the injury may not show or look serious at the time, all such wounds and bruises will reveal an absolute blank, or a yellow-jaundiced look, more disfiguring than a blank, soon after the injury has been inflicted. To prevent these and other injuries to Box edgings, a Box-bridge of some sort should always exist in gardens where living edgings are much used. This may consist of a straight piece of board a yard long and three or four inches wide, with a cross-piece four inches deep nailed on one end; this is placed a foot or so inside the Box edging, and the other end on the walk, thus enabling barrows to be wheeled over without injury to the edging. Other bridges are curved or hollowed out in the middle so as to clear the Box, and afford an easy passage from either side.

Though there is no doubt that the common garden Box—that is, *Buxus sempervirens nana*—is the best edging plant for the kitchen garden, the following succeed well in various localities: the four variegated Euonymuses—*argentea*, *variegata*, *aurea variegata*, and *latifolius aurea marginata;* the silver and golden variegated Yew; the golden Japanese Honeysuckle; the silver-leaved, golden, and green Periwinkle; *Andromeda latifolia*, *Kalmia latifolia*, the smaller Retinosporas, *Veronica incana*, *Osmanthus variegatum nanum*, *Pernettya macronata*, and on light or peaty soils such hardy Heaths as *Erica ciliaris*, *E. c. alba*, *E. tetralix*, *E. t. alba*, *E. Mediterraneas*, *E. M. alba*, *E. multiflora*, *E. m. rubra*, *E. calluna*, *E. vulgaris alba*, *E. v. aurea*, *E. v. coccinea*, &c. Where such plants thrive, nothing can well look more charmingly beautiful than some of them either in kitchen or flower gardens. Then the variegated and other Ivies, especially such a strikingly beautiful one as the golden Japanese Ivy, are a whole host in themselves. The silver and other Maples, common and purple-leaved Beech, purple Filbert, and some of the finer Berberries, Butcher's Broom, and Cotoneasters, make striking walk edgings.

Among herbaceous plants, the Thrift, or Sea-Pink, of which there are several varieties, the blue Gentian, and the Moss-leaved Saxifrage, the common House-Leek, and other Sedums, form good and permanent edgings. Primroses, Violets, Daisies, and many other dwarf compact-growing plants, have hardly sufficient bulk or permanency in winter for edgings. Thyme, especially the Golden Lemon, and other herbs, such as Chives, Burnet, Pennyroyal, and Parsley, are often used as an edging plant in kitchen gardens, and some of the many varieties of the extra-curled Moss-leaved Parsley, such as Beauty of the Boudoir, are among the most beautiful of all edgings. Unfortunately, however, unless the walks are specially smooth, hard, and clean, the Parsley gets splashed and spoilt for use in such positions.

While living edgings are the most pleasant, they are seldom the most profitable. Most of them are rather troublesome to make and keep, and need renewal every few years. Most of them exhaust the soil very much, especially along their inner or crop-growing side. Box especially has a wonderful tendency to seek out, run into, and exhaust the good properties of the earth in contact with it, and to grow to excess in consequence. Other living edgings, especially such as Ivy, grass, and Box, form harbours for slugs, worms, and other garden pests, in which they breed with extraordinary rapidity, and defy destruction.

The use of living edgings also prevents the use of salt, poison, or hot water, in the keeping of the walks free from weeds. All such walks must either

be kept clean by hand-weeding, or by the old-fashioned plan of hoeing, raking, and rolling, several times a year. Though the last involves a considerable amount of labour, it is not labour lost in kitchen and fruit gardens, in which comparatively loose and frequently scarified walks will prove most favourable to the roots of fruit-trees, bushes, and those of other crops, that often run further and increase and multiply faster under the walks than anywhere else.

THE LIFE-HISTORY OF PLANTS.

By Dr. Maxwell T. Masters, F.R.S.

GROWTH OF BUDS.

IN considering the seed, it was shown how, in the first instance, before the seedling could in any way shift for itself, it was dependent for its food upon the stores laid up beforehand for its use in the perisperm or elsewhere. The genial heat of spring might, indeed set the juices in motion, but of what avail would that be were there an empty larder? Provident Nature, however, takes care that this shall not be. The life-work of the plant whose course we have to trace largely consists in the formation and accumulation of reserve supplies for future use. As it was with the seedling, so it is with the bud. Apart from the special peculiarities of its origin— a matter to be hereafter alluded to—a seedling has much in common with a bud, structurally and functionally. With the exception we have noted, its history is much the same.

Fig. 18.—Terminal Bud of Ash, enclosed in Bud-scales. Two side buds of later generation are seen beneath.

Nature of Buds.—Speaking generally, and for the moment without reference to detail, a bud consists of a central growing point, surrounded by scales, as shown in Figs. 18—21, showing the buds of various plants still invested by scales, or in process of growth, during which the scales separate and ultimately become detached. The expression "growing point" is applied more particularly to those parts of the plant by the increased development of which the plant grows in length. Strictly speaking, it should not be confined exclusively to growth in length, but as no inconvenience arises from the limitation, we need not dispense with what is a convenient and intelligible symbol. In the seedling plant, as has been already mentioned, two such growing points were specially noticeable, the one with a general tendency to grow downwards, to form the root, the other with a propensity to grow in the opposite direction, and to form the stem and its subdivisions, the branches. In the bud there is, to begin with at least, only one such growing point, and its tendency is to grow upwards. It may be objected that in many cases it grows sideways rather than upwards, but that is an accident of its position not affecting the general truth of the statement. In Fig. 18, for instance, if any accident occurred to the end bud, the side ones would probably lengthen into shoots at once, without waiting as they otherwise would do. Wherever the growing point has fair play, and is free to grow as it pleases, it grows more or less vertically upwards. The growing point of a bud, then, is the structural equivalent of the plumule or rudimentary stem of the seedling.

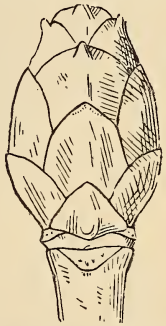


Fig. 19.—Unexpanded Bud of Horse-Chestnut.

How Buds are Nourished.—It has been shown whence the plumule derives its food, and we have now to inquire from what source the young bud gets its supplies. Obviously the bud-scales, dry and thin as they are, are not likely as a rule to contain much food. They cannot act as foster-mothers to the young bud. Moreover, there are plenty of buds destitute of any scales. The only other available source is the branch from which the buds spring, and here, in fact, we shall find an abundance of food stored up in reserve, just as we did in the perisperm of the seed. Beneath the young rind or the dry scaly bark of a twig, between it and the central woody or pithy matter, there is a store of

available nutriment. Just beneath the skin of a human being, or of any animal, there is a thin layer of granules of fat, capable of being used in the nutrition of the body, and deposited for that purpose. So it is with ordinary trees or shrubs. Just beneath the outer layers of the rind or bark, which are mostly dead, there is a layer filled with nutritive matter—abundantly so in late autumn and winter, less markedly so in spring and summer,

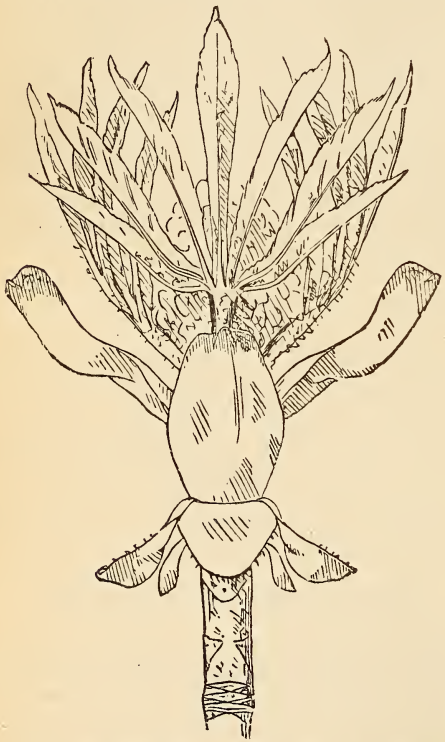


Fig. 20.—Expanding Bud of Horse-Chestnut, showing the bud-scales which fall off as the leaves develop.

while growth is going on actively, and there is a brisk call on the resources of the plant.

It is found, moreover, by anatomists, that the buds originate in the vicinity of this food-layer; they do not spring from the deeper central portions of the stem, but from the portions nearer to the surface. The operation of budding affords a familiar illustration of this. In this process a bud from one plant is implanted beneath the bark of another, care being taken not to cut the stem too deeply, but only to the level of the food-layer, in the immediate vicinity of or actually in which the bud is implanted. (See Figs. 22, 23, also page 233.) In this case, then, the transit of food and fuel to the machine requiring it is a short one. The bud, like the seedling plant, is thus at first dependent on the funded capital reserved for its use. That capital may roughly be compared to bullion; before it can be realised and rendered available for use, it has to be coined, and this process of converting bullion into coin is, as it was in the case of the seed, the conversion of the insoluble into the soluble —a conversion effected, it is to be presumed, in the same manner and by the same agency as already de-

Fig 21.—Leaf-bud of the Poplar.

scribed in the case of the seed. Before any part of the plant, seed, or bud can earn an income for itself, it is necessarily dependent on stored-up capital. It uses up that capital in the formation of new growths and in the development of force, as we shall hereafter see. The relations and the due proportion that capital, income, and expenditure bear one to the other, require to be, and are, adjusted by the living plant with the utmost nicety. The business of the physiologist is to find out as much as he possibly can of these complicated but all-important relations, and of the circumstances, external or in the plant itself, which control or modify them. It is the business of the gardener to turn the information so acquired to practical use.

Periodicity of Life.—One thing of great importance to determine is the time at which these several operations take place, because the successful treatment of the plant under cultivation must of necessity be regulated by it.

"There is a time for all things," we are told, and that is true, but its truth does not preclude the possibility of the concurrent action of different things at the same time. A plant in full activity, like any other living thing, is certainly spending and gaining at one and the same time, but unless a proper ratio be observed, its activity declines or becomes deranged. In the spring of the year expenditure is in excess of income, and if there were no reserve to draw upon, it is easy to imagine what the result would be. Gardeners attribute the character of the following season's growth to the "well-ripened" or "ill-ripened wood" of the previous autumn, and though the expression is perhaps open to some technical exception, it nevertheless covers a substantial truth. From this point of view, the ripening of the wood, the mere skeleton of the plant, is not of so much consequence, but rather the formation and storage of food in the inner bark and, to some extent, in the young unripened wood. Unless during the summer and autumn a sufficiency of suitable bullion-food—if we may be allowed such an expression—be laid up in the store-places of the plant, the growth will be poor in proportion, because there will be no coins to make it with. This constitutes one difference between annual and perennial plants. The energies of an annual plant are concentrated in the formation of seed; this effected, there is no other store-house to be filled with bullion, and the individual plant dies, leaving the seed only to continue the race. In a perennial plant the energy and life-work is not solely concentrated on seed-production, but food is stored up in the bark, in the tuber, in the bulb-scale, or elsewhere; and the individual plant does not wholly die, but bark or bud, tuber or root-stock, or what not, remains in a relatively quiescent state, to burst forth again into activity at the appointed season. This brings us back to the consideration of the bud as a growing point formed in summer or autumn, quiescent through the winter, roused into activity in spring, drawing upon the reserves for its supply, and at first incapable of earning income for itself.

Fig. 22.—T-shaped Cut in the Bark of a Rose to allow of the insertion of a Bud.

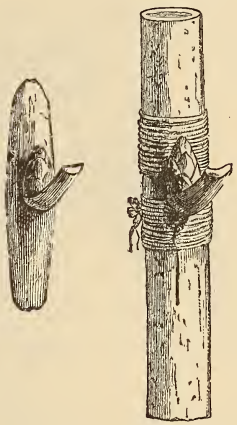


Fig. 23.—Bud of Rose detached, and inserted within the Slit of the Bark, as in budding.

Individuality of Buds.—An ordinary shrub or tree naturally bears hundreds of such buds, but though thus associated and growing from a common stem, yet each bud has an individuality of its own—an individuality in some cases so strong as to enable it to live and go on its way without the aid of its fellows. An instance of this has already been cited in the case of Rose-budding. If the detached bud were not in a measure self-contained, it could not be transplanted with the successful result that gladdens the Rose-grower. A "cutting" or a "slip," again, is nothing but a portion of the stem or branch bearing one or more buds, which, with the necessary care bestowed by the gardener, in due time grow into shoots as if they had never been severed from the parent stem. So, too, there are some plants in which the buds become in course of growth naturally detached, and grow into distinct plants. This is the case with the Tiger Lily, whose deciduous buds are in fact small bulbs, the fleshy scales of which contain the food necessary for the young bud till it can shift for itself.

Another illustration of the independence of individual buds is shown by the growth of a Vine in a lean-to green-house; the buds at the upper part of the cane in the warm corner next the top of the house burst into leaf before those at the lower part, because they are subjected to more light, and more especially to greater heat, than those at the bottom.

So with a Wistaria growing outside, but in which one branch has been allowed to enter the green-house; the buds outside may be still at rest, while those within are in full leaf and flower.

In these cases the buds have, stimulated by the heat, availed themselves of the resources in the stem, long before other buds, less favourably situated, could do so, and before root-action is set up in the roots growing outside.

The terminal bud—that one placed at the end of

each shoot—is usually larger and better developed than the rest, and very generally it expands before the side buds in spring (as shown in the case of the Ash, Fig. 18). This earlier expansion is generally attributed to a fuller supply of "sap," which, as it is said, rushes more freely in a direct line to the terminal bud than it does to the side ones which it reaches obliquely. But, as has been shown, the buds begin to expand before there is any such rush of so-called sap as is here assumed, and the real explanation is probably to be sought in the earlier production, larger size, and usually more favourable position of the terminal bud as regards exposure to solar influence. A curious illustration of this is afforded by various Conifers. Take for example *Abies Nordmanniana*. Here the leader shoot consists of a cluster of buds, a central one surrounded by a ring of side buds. On the gardener's hypothesis the central one, from its erect position, ought to start first. But it is not so; the side buds are in this case placed nearly horizontally, and start first into growth, stimulated thereto probably by the greater amount of sun-heat impinging on them more directly than on the erect terminal bud. That light of itself is not the main agent in stimulating bud-growth is obvious from a variety of considerations, some of which will receive attention further on. At any rate, the universal experience of those who have to "force" plants is that heat is the essential agent in starting bud-growth.

Fig. 24.—Bud of Red Currant, showing leaves and inflorescence springing from the same bud.

Another reason for the earlier development of certain buds than others, and one also illustrating the comparative independence of individual buds, is to be sought not in any supposed greater rush of sap in any particular direction, but in the presence of larger or more readily available supplies in one place than another. Some Pear-trees under observation in early spring, had some of their branches as usual contracted and thick, others thin and long. The former are what gardeners call "spurs," and it is on them that the flowers, and ultimately the fruit, are specially developed. The other thinner branches are the result of the "extension shoots," which bear mostly leaves only, and whose office it is more particularly to form the framework of the tree. The "spurs" have relatively much less wood in them, but are laden with food to a much larger extent than the "extension shoots," as might naturally be expected from the work they have to do. In the case before us, however, the "spurs" did not all bear flowers, but some of them leaves only, and these leaves, at the time of writing, were fully expanded, while those on the "extension shoots," where the available nutriment was less abundant, were still at rest, or at most only slightly unfolded. The earlier expansion of some buds is then due partly to their age, position, and direction, insuring earlier and fuller exposure to favourable conditions, and partly to superior advantages in the way of obtaining food.

Varieties of Bud.—Having glanced at the general character and work of the buds, we may now enter a little more fully into detail as to their varieties. Full particulars must be sought in botanical text-books, and still better by a careful examination of the buds of all plants that come under observation. In particular, the conformation and arrangement of the bud may be recommended to young gardeners as not only easy of observation, but of primary importance to them in such practical matters as pruning and training, the development of flowers, or the growth of wood. The disposition and structure of the bud of the plants they have to cultivate should form one of their first studies; and as a guide to practice they will find it necessary to revert to it again and again. This may be understood from the circumstance that the arrangement of the flowers, the shape of the tree or plant, and the disposition of its branches, all depend upon the nature, arrangement, and mode of growth of the buds. In this place we can only deal with certain generalities, such as the distinction between leaf-buds, or wood-buds, as gardeners call them, and flower-buds. Usually, the leaf-buds are more elongated and sharply pointed than the flower-buds, which are rounded, or egg-shaped. Moreover, they frequently occupy a different position. It must, however, be remembered that in very many cases, as in the Pear,

or Currant, leaves and flowers are combined in the same bud. The position of the bud at the ends of shoots, as shown in Figs. 18, 19, 20, or at the sides, as in the Poplar, Fig. 21 (terminal and side buds), has been already alluded to, but with regard to the side buds it may be pointed out that, although not exclusively confined to those situations, they very generally arise from what is called the "axil" of a leaf, by which is meant the angle formed at the junction of the leaf with the branch that bears it. This little nook or corner is the "axil," and a bud occupying such a position is spoken of as "axillary." Generally only one bud is found in the axil of a leaf, but to this rule there are very many exceptions, as, for instance, in the Peach, wherein on the lower parts of the shoots the buds are placed singly, higher up they are ranged in pairs, or in threes. In the latter case the side buds are usually flower-buds, the central, thinner and more pointed, being a leaf-bud. It is important also to note that the terminal bud of necessity belongs to a generation anterior to the side bud. The absolute difference in point of time may be, and is generally, slight between the formation and development of the end and of the side bud respectively; but occasionally, as after an injury from frost, insects, or other cause, the difference becomes one of practical importance.

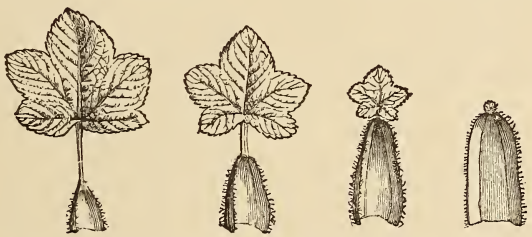


Fig. 25.—Bud scales of Red Currant, showing the transition from scales to perfect leaves.

Buds may be formed in other situations besides those mentioned, wherever there is nourishment at hand, and wherever there is a growing point or tissues which, not being reduced to a quiescent state, as in the case of the so-called permanent tissues, are still capable of forming one. It very frequently happens that buds are formed, but which under ordinary circumstances never develop, remaining "dormant." In consequence of this buds are, as just alluded to, frequently developed as the result of any injury which stimulates the formation either of "adventitious buds," or rouses into activity the dormant buds above spoken of. Illustrations of this are met with in the case of pollarded trees. Buds may also be formed without previous injury on the leaves, as in *Bryophyllum;* and some plants (*e.g.*, Gloxinias and Begonias) are constantly propagated in this way, the leaves being fastened down to the surface of the soil, and kept in a warm moist atmosphere. Such cases do not invalidate the rule that buds are formed at the expense of reserve materials, seeing that they derive their nourishment in the first instance from the leaf on which they are borne.

Bud-scales.—Many buds, but by no means all, are invested by scales—bud-scales, as shown in Figs. 18—21. This is the case with "winter buds," which, formed in summer, have to remain dormant through the winter till the following spring. The scales are generally merely degenerate or abortive leaves—serving the purpose of protecting the young growing point, and the tiny delicate-structured leaves emanating from it, from the effects of radiation, or from the penetration of cold or moisture from without. They serve, in fact, the same purpose as the seed-coats do for the seedling plant. To these ends they are not unfrequently invested with hair, or covered with a resinous or waxy exudation which answers the same purpose. That the bud-scales are merely modified leaves is seen by the circumstance that they are arranged in the same manner, and that in many plants all degrees between a scale and a perfect leaf may be met with—as, for instance, in the bud-scales of the Currant, as shown in Fig. 25.

COMMON GARDEN FLOWERS.

STOCKS, WALLFLOWERS, SNOW-IN-SUMMER, THRIFT.

The Gillyflower Stock (*Mathiola*).—Several flowers have borne the common name of Gillyflower, such as the Carnation, the Leucojum, and the Hesperis, or Rocket; but now-a-days we associate with the term both the Stock and the Wallflower. Now the Stocks form a large group; there are Ten-week Stocks, Queen Stocks, Brompton Stocks, Intermediate Stocks, and one or two others. The most common in our gardens are the Ten-week Stocks, but these are annuals; the Intermediate Stocks are biennial and annual both, but they are generally made biennials by sowing the seeds in July and August and flowering the plants in spring; the Queen and Brompton Stocks are true biennials, flowering in spring and early summer.

The annual or Ten-week Stocks are a large group, and include a great variety of colours. They

are divided into types—that is to say, some are much finer than others; the common Ten-weeks are inferior to the Pyramidal and the Perfection; the two latter are of taller and stronger growth, and produce very fine spikes of large double flowers, and they are recommended to the attention of those who grow Stocks for exhibition purposes. Some are more branching than others, but all are very good; and for general garden purposes the ordinary Ten-weeks will be found satisfactory.

Annual Stocks are classed among the half-hardy annuals, and it is best and safest to sow the seed under glass about the end of March, in pans or shallow boxes, filled with sweet, light, sandy soil. By the middle of May the plants should be getting quite strong; the pans can be placed in a sheltered spot in the open ground, and when the plants are a little hardened they may be transplanted into their permanent places, either in beds or borders, in a good rich loam. This is supposing there is no cold frame at the disposal of the cultivator, but if there is, and he can prick out his seedling Stocks into a well-prepared bed, he will find it of great advantage to do so, as when transplanted with nice balls of roots they will do so much better in consequence, grow stronger, and come into flower earlier. Some growers of Stocks sow their seeds in the open ground in April, and when the plants have grown large enough, thin them out, and leave the strongest to flower. By doing this any check from transplanting is avoided; but the seed should be sown in the open ground only when the soil is rather light, sandy and rich. There is another thing to be said in favour of sowing seeds of Stocks in the open ground: there are no losses of plants from mildew, such as frequently happens when the seeds are raised in a frame.

The Intermediate Stocks are most valuable for house and window decoration in the spring, and thousands of plants are grown and sent to market in spring in pots. There are two colours generally grown—the scarlet and the white, and although the scarlet is the most common, the white is not less pleasing and effective, and both are very double, fine in colour, and richly fragrant. The best time to sow seed of Intermediate Stocks is in September, and it should be done in a house or cold frame early in the month, and when large enough the plants should be pricked singly into small pots; or place three or four plants into a larger pot to stand the winter. The usual practice is to grow single plants in a four-inch pot, and when put in good soil they make fine bushy specimens, blooming freely and finely. One chief use of Intermediate Stocks is to put them into outside window-boxes in spring, where they are very gay. Any small plants can be put out into the open border in spring; but in order to preserve Intermediate Stocks safely through the winter, a greenhouse or frame is absolutely necessary.

There is a strain of Intermediate Stocks known as the East Lothian. This is identical with the autumnal Stocks of the German growers, and is represented by a dwarf, free-growing, bushy, hardy strain, that freely flowers in autumn if the seeds be sown early in the year, and the plants placed in the open air in good soil. There are no Stocks freer in flowering than these autumnal types; and if the winter be mild they continue to bloom all through the spring. They are much used in Scotland, and that is how it is they have come to be known as East Lothian Stocks. They are well deserving the attention of the flower gardener.

Under the head of Brompton Stocks we get three or four types differing somewhat in character, but all are remarkable for the size of their spikes of bloom, and their striking appearance in our gardens during May and June. True Brompton Stocks are of tall, vigorous growth; the scarlet and white giant varieties produce remarkable spikes of large double flowers. There is a giant purple variety also, but it is somewhat scarce. On the other hand, the Queen Stocks are dwarf and bushy, and very free in bloom; and it is the purple, white, and scarlet flowers of these that can be seen in bunches in Covent Garden and other markets during the months of May and June. A good strain is very double in character, and no better or more useful biennial Stocks can be grown for cutting purposes. The Emperor Stocks are between these two, having the characteristics of both; individual plants branch very much, and throw many and fine spikes of bloom. They represent, in all probability, a giant form of the autumnal Stocks. Then there are the dwarf Cape Stocks, closely resembling the Emperor, rather freer in growth, but not quite so prolific of bloom as the autumnal varieties. The colours of all these four types are limited; the best are purple, white, and scarlet. We have described their characters a little fully because they are found in seed catalogues, and we are desirous that our readers should know as much about them as possible.

Seeds of all the biennial Stocks should be sown in the open ground during May and June; the result will be good strong plants for transplanting during showery weather about August. These Stocks do well under the shade of trees and shrubs; for if too much exposed on cold soil they are liable to damage from frost, especially if the plants be very robust and succulent.

There are two or three points about Stocks that are a little puzzling. One is the existence of what are known as Wallflower-leaved varieties. The leaves of the ordinary Stocks are greyish-green, soft and

German Large-flowered Ten-week Stocks.

downy. The Wallflower-leaved Stocks have leaves of a bright shining green, smooth, and without a particle of down. How did the Wallflower-leaved varieties originate? We cannot get any satisfactory reply. The foliage is in direct contrast to that of other Stocks. In keeping the various colours of Stocks true for seed purposes, there is one very difficult circumstance. Certain sorts invariably produce a difference in colour between the double and single flowers. This is clearly illustrated in the sulphur-yellow varieties; in these the single flowers always come white. Sometimes, as a consequence, a pure white Stock will come among the yellow varieties. Lastly, it is necessary to state that double Stocks never produce seeds. Only from single flowers can seed be saved. But the plants are so treated by artificial fertilisation under glass, and by the assistance of insects in the open-air, that the seed will produce a large percentage of double flowers. A good strain of Stocks will yield from 75 to 85 per cent. of double flowers; but very rarely indeed will all the plants raised from a packet of seeds produce double flowers; and surely this is a circumstance no one can regret, for should seed of Stocks produce all double and no single flowers, there would then be an end to this beautiful class of common plants, for there would be no seed to raise them from.

Wallflowers.—The botanical name of the Wallflower is *Cheiranthus Cheri*, and it is derived from *cheir*, the hand, and *anthos*, a flower; in reference, it is supposed, to the custom of carrying the Wallflower in the hand for a nosegay. The common Wallflower is a native of the South of Europe, and was introduced to this country in 1573. It has now become quite naturalised on old walls and ruins in this country; and we think it is very probable many readers will be surprised to learn that a common flower which has spread itself everywhere over the face of the country is not indigenous to it.

In an old gardening book published 150 years ago, we read, "The common single Wallflower is very seldom cultivated in gardens, but the double of this kind is very common in most of the English gardens." Exactly the reverse is the case now; for while the single types are very largely grown, the old double forms of the English Wallflowers are now seldom met with. Hundreds of acres of dark or blood Wallflowers are annually planted in the market gardens round London to supply Covent Garden and the other flower markets; and instead of these blooming in March, April, and May, so carefully has this variety been selected, that we have now an early-blooming strain, appropriately named Harbinger, that is in flower in October, and when the winter is mild they flower all through that season.

There are three distinct types of single Wallflowers, viz.: the Blood-red, from which Harbinger is a fine selection; the Yellow Tom Thumb, which is something of a misnomer, because it is rather a tall-growing variety, bearing fine pure yellow flowers, and the Belvoir Castle Dwarf Yellow, a pure yellow, very dwarf, and extremely free-flowering variety. These originated by means of careful selection, and they are of great value in the flower garden in spring and early summer. Now, the Blood-red Wallflower has seeds of a red colour; so has the Yellow Tom Thumb; but the Belvoir Castle has quite small seeds of a yellow colour, like the flowers; so any one possessing this knowledge can soon tell whether they have seed of the true thing or not.

There are German Wallflowers also, so named because they are grown by the German seed-growers: and they are both single and double. They are of several colours; among the single German varieties will be found some having shades of purple; attempts have been made in this country to fix these purple shades, but without avail, as seed from these will produce dark varieties. The German single Wallflowers are of tall growth; unlike that of our market strains of dark Wallflowers, which are of a very dwarf and compact branching growth; so that an individual plant of the latter throws a large quantity of flowers.

As a general rule, seeds of Wallflowers are sown much too late to have strong plants to flower in the spring following, for Wallflowers are true biennials. Those who grow for market sow their seeds in May and the early part of June; and gardeners of all degrees should follow their example. When the seeds are sown late, the plants do not properly mature their growth by winter, and are apt to make but a poor show of bloom. The plants should in their season be solid with bloom, not dotted with it merely; and well-developed plants form little mountains of fire and gold. And then the flowers are so richly fragrant, that scarcely any other common flower can compete with it in this respect. Therefore, sow Wallflower-seeds in May and June in the open air, in an open sunny spot, on rather poor but level and rather gritty soil, which is favourable to free-rooting. As soon as possible after the plants are two inches high, they should be transplanted into rows six inches asunder, and three inches apart in the row. In about three weeks or a month, the plants should be again transplanted, lifting every other row, and each alternate plant from the rows that remain; thus leaving a certain number to grow into size. The plants that are removed should be planted six to nine inches apart every way, and have a little water if needed, to help them into a free growth. Wallflowers treated in this way come in very useful

indeed to fill the flower-beds during the autumn and winter; they furnish the beds with cheerful green during the dull season, and make charming masses of flower in spring. The Wallflower is very hardy, and it is only very severe frost that harms the plants, or sharp frost following upon excessive wet.

A fine and distinct new yellow Wallflower was recently shown at one of the meetings of the Royal Horticultural Society, and named Bedfont Giant Yellow; a rich golden, dwarf, compact and robust variety, but with dark seeds.

There are two old-fashioned double Wallflowers that have been occupants of English gardens for many years. One is dark, the other yellow-flowered. One, if not both, was, it is believed, imported from the South of Europe. They do not seed, and can be propagated only by means of cuttings, which can be removed in spring and summer, and struck in pots of light sandy soil. One sometimes meets with these old double Wallflowers in cottage-gardens, growing in borders, and flourishing. The sort of border that suits the double Wallflowers best is one adjoining the wall of a green-house, and the soil should consist of equal parts of good sandy loam, and broken bricks and old mortar, two feet in depth, resting on a dry subsoil. In such a border the double Wallflowers will live for many years, and become as large as shrubs. Any aspect will suit them, but a border facing south or west is best.

There are in addition the double German Wallflowers. These are grown only by the German and other Continental florists; they are of strong growth, throwing up a main stem bearing fine double flowers much varied in character. The seed of these should be sown in June, the plants pricked out to grow into size, and then planted out in a prepared bed. Or if there is any risk, they can be wintered in pots in a cold frame, and planted out to flower in spring and early summer. The double German Wallflowers seed very sparingly indeed in this country, and therefore we have to look for a supply from the Continental florists.

The best strains of Wallflowers are:—

Covent Garden Blood-red.
Harbinger.
Bedfont Giant Yellow.
Belvoir Castle Dwarf Yellow.
Carter's Yellow Tom Thumb.

Snow-in-Summer. — The Snow-in-Summer, Mouse-eared Chickweed, or Cerastium, belongs to the natural order *Caryophyllaceæ*, and several of them are common weeds in different parts of Britain and the more northern parts of Europe. Some are annuals; but those most deserving of cultivation are evergreen perennials, varying in height from four inches to a foot or more, though the best and most popular variety, *C. tomentosum*, seldom reaches to six inches. The flowers of the whole family are pure white, and they bloom from April to August. There are a good many species or varieties of Snow-in-Summer, but only three are really deserving of general cultivation; and possibly the other two are only larger varieties of the hoary-leaved species, *tomentosum*, or common Woolly Cerastium. The leaves are so white, fine, and small, and soft to the touch, as to well deserve the descriptive appellation of woolly. The flowers are small and round, of the purest white, and are produced in such enormous quantities in May, June, and July, as to completely hide the spreading leaves and branchlets, and well merit its common name in some localities of Snow-in-Summer. The foliage, as already stated, is almost as white as the flowers, and thus the ground is whitened or snowed over twice. Those who have never seen the Cerastiums in mass, either as huge tufts or edgings, can form no idea of their rich and striking effects in flower-beds or borders, or in larger rougher masses in the wild garden or shrubbery. So strikingly effective are they when in mass, and so early and profusely do they bloom, that it may often be said of many gardens, that all the borders are brides long before the other plants are ready to receive them. Fortunately, however, their bride-like purity remains after the flowers fade, for, as already remarked, the foliage of those here commended is almost as white as their hosts of tiny cup-like bloom. So much is this the case, that those who use the Cerastium most extensively for ground-works on which to pincushion other plants, as dividing lines to form chaste patterns on beds or borders, or as pure white edgings to last throughout the year, seldom allow it to bloom, but clip all the flowers off in bud. By thus husbanding the strength of the plant, and preventing it alike from the exhaustion incident to flowering and seed-bearing, the foliage becomes more vigorous as well as whiter; and no cheaper, hardier, or more effective permanent edging or line can be made and kept than that of the *Cerastium tomentosum*.

But even these are hardly so effective as large bold masses of the Snow-in-Summer by the side of masses of Aubrietias, Forget-me-nots, *Viola lutea*, or other yellow and purple Pansies, red Daisies, pink or yellow Primroses, purple Clarkias, or blue Nemophilas. *Cerastium Biebersteinii* has larger leaves and flowers than the *tomentosum*, and when first introduced from the Taurian mountains it was thought highly of, and largely propagated to supersede the older species. It was found, however, in practice to be less hardy and scarcely so white in the mass as the older and smaller species, and is now but

little grown or cultivated. It is, however, worthy of cultivation, and the flower being considerably larger, some prefer it on that account. *C. grandiflorum* is a stronger plant, with larger flowers and less silvery leaves than either of the other two. Because of the latter, possibly, it is a stronger grower, and is a most useful and showy plant for the mixed border or Alpinery. Neither of these, however, is often seen in small gardens, and in this case the cottagers, artisans, and suburban gardeners who have the *C. tomentosum* have the best of the family.

The Snow-in-Summer spreads so rapidly into tufts and masses, forming roots as it runs over the earth, that it can hardly be said to need any cultivation. Nevertheless, if left too long in one place, its prodigality of flowering and of growth is apt to result in bald patches in the centre of large tufts, and ragged places in old edgings. To prevent this it is a good plan to keep up a young stock of these useful plants. A few patches can be torn asunder, or pieces cut or torn off wide edgings in October or November, and laid in an inch or two deep, in rows, on any spare bit of ground, treading the pieces, it matters little whether they have any roots or not, firmly in. These will be nicely rooted and fit to form fresh patches or edgings in March or April.

Common Wallflower.

Or the division may take place in February or March. But should a dry time follow, the Cerastiums will need frequent waterings to assist their rooting and re-establishment at that season. Where small lines are desired it is a common practice to take off single cuttings in March, dibble them in firmly, from one to three inches apart, placing two or three inches of the cutting in the ground, and merely the point left out. Should dry weather ensue, sprinkle overhead occasionally until the cuttings are established.

If required in quantity for forming lines or patches in winter, the Cerastium should be divided as already explained, and lined out in a shady place in good soil in May or June. These midsummer cuttings or pieces will soon root and be ready for forming white patches or lines of great purity and beauty in October or November.

The Cerastiums seed freely, but as this exhausts the plant and also renders the leaves less white, and they are so readily and largely increased by the means already pointed out, it is not desirable to allow them to ripen seeds.

Thrift, or Sea-Pink.—This plant, the *Armeria vulgaris* of botanists, belongs to the natural order of Leadworts (*Plumbaginaceæ*). Being a native of our own sea-shores, of the Scotch mountains, and other cold and elevated parts of Europe, it is one of the hardiest as well as the showiest of common garden plants. The white and pale red-coloured varieties of the species are frequently found wild, the former, however, being far more common than the latter. But neither of these is much grown in gardens, the red-flowered variety, *Armeria coccinea*, being so much more effective. The common wild Thrift, however, is met with at times in old-fashioned gardens, and the white variety of the species is worth growing, as it is rather scarce under cultivation. They all flower about the same time, through June and July, and if the old flowers are cut off closely

down to the compact grass-like foliage so soon as they begin to fade, and to prevent their seeding, the Thrifts will generally, on good soil, flower a second time, though far less freely, through August and September. Treated thus there are few better edging plants than the brilliant-coloured varieties of the common Thrift.

They soon spread out into a thick grassy-looking line six or more inches wide, and as the flower-stems rise above the leaves from six inches to a foot, and bend with their own weight over the sides, the result is a band of glowing colours and a mass of semi-round bloom a foot or more wide. The great Round-headed Thrift, *Armeria cephalotes*, though not nearly so well adapted for edgings, forms a yet more effective plant for a bold mass, in either bed or border. The leaves are much wider and larger, the difference being almost as great as that between Leeks and Chives, though neither of the Armerias is a bit like either, but the contrast in size is almost equally apparent. The flower-stems on good soils average eighteen inches, and may reach to two feet in height. The flowers are large and closely-packed masses, somewhat resembling some of the Statices, hence the name of *Statice lusitanica* is sometimes given to this giant Thrift. There are said to be deeper-coloured varieties of it, but the writer has not seen them. A pure white and a deep scarlet variety of this monster Thrift would prove among the most welcome additions to all gardens, large and small. This species is sometimes confounded with *formosa*, but the colour is different, and also the habit to some extent, though the Thrift grown under the latter name is about as tall as *cephalotes*. The names, however, of *latifolia*, *pseudo-armeria*, and *mauritanica* have been applied indiscriminately to *A. cephalotes*. While as regards size it is a great improvement on the common Thrift, it is in no respect a substitute for it. While more effective for forming striking tufts or masses of colour further back on the mixed herbaceous bed or border, it is of no use as an edging plant. Unfortunately too, being a native of Africa and of the lower altitudes of the South of Europe, this large Thrift is far less hardy than the dwarfer ones. It is, however, well worthy of a sheltered sunny spot in every garden.

There are several other species and varieties of Thrift, one of the most common being *maritima*, very much like the common Red Thrift, but mostly of a more vivid colour. This is the sort most commonly found near the seaside in different parts of Great Britain, and very often met with in old-fashioned gardens.

The common Thrift and its varieties, and all the other dwarf-growing species and varieties, are easily propagated by division. As clumps and borders when left too long in one spot are apt to become bare and bald in the middle, it is good practice to sever them every second or third year.

The best time for this operation is soon after the bloom has faded, say in August. If the plants are lifted bodily at this season, divided into convenient pieces, and immediately re-planted, they will be nicely re-established next year, and flower as freely the following season as if nothing had happened. They should be planted firmly in fresh soil if on the same spot, for the Thrift, from its enormous floriferousness, speedily exhausts the soil.

From the very nature of the plant, and the positions in which it is found to thrive best in a state of nature, a rather deep sandy loam on a dry bottom suits it best. From the density of the mass formed by Thrifts, the frosts occasionally, in severe winters, almost raise them out of the ground; and one of the best means of culture for the common sorts is to tread them firmly back with the foot, or when practicable, as it often is in the case of edgings, to run a roller over them. The giant Thrift does not multiply so rapidly as the more dwarf varieties, and hence cannot be so speedily propagated by division. But, on the other hand, it ripens seeds more freely in favourable positions, and these may be either sown so soon as ripe on light sandy soil in a sheltered spot, or in the spring. Sow very thinly, for Thrifts, especially the larger ones, resent root-disturbance in a small state, and ought to remain undisturbed in their seed-beds till large enough to transfer to their blooming quarters.

THE KITCHEN GARDEN.

By William Earley.

CULTURE OF VEGETABLES.

Celery (*Apium graveolens*). French, *Celeri;* German, *Sellerie;* Spanish, *Apio*.—Celery is a native British plant, flourishing in country ditches, commonly known as "Smallage," and a biennial, of poisonous import in its native state. Cultivation and the system of blanching in vogue have changed it into one of the most valuable comestibles the vegetable garden lays claim to. Though a wild plant, and excessively hardy and durable, it requires, nevertheless, the most studied and generous treatment under culture to insure to it that state of perfection, or merit, which belongs to it.

The soil most suited to it, under artificial culture, is one moderately moist, rather stiff, but thoroughly worked or broken up, and very liberally intermixed with good old, or thoroughly decomposed, manure.

Seeds, to secure the needful crops, must be sown in

accordance with the date fixed when each separate one is to be ready for use. Any departure from such a rule often entails disappointment. Accordingly, successional crops must be the result of successional sowings.

When the first crop is required for use early in September, or somewhat before, a slight sowing should be made about the second week in February; the successional one about mid-March; and the third during April. Each will succeed best in a box of rich, fine soil, placed under glass in a moderate amount of heat. Though for the latter sowing, if it were possible, the best place is to sow upon a fine bed of soil, elevated up near to the glass, during the first few days of the month; covering the seed over very slightly in this, as in all other cases, well watering them and shutting the frame up close until germination takes place, when, by air-giving, &c., a sturdy and full growth is assured.

From the moment when the seeds germinate until such time as they are moulded up in the rows for blanching, no check of any kind must be permitted, or the result will be adverse to the whole future growth, with a probability of "bolting," or the too early starting into seed-stalk, of some, which destroys all tenderness.

To insure a regular and uninterrupted growth from the seed-bed onwards, the young seedling plants must be "pricked" out, or transplanted singly into other boxes or frames so soon as they are large enough to handle, and be again transplanted, as necessary, as they continue to grow and require space. The best place wherein to transplant early ones is a well-elevated bed of rich soil in a cold frame, over which a mat can be placed during severe frosty weather. For the permanent crop, a bed should be made up in a warm sheltered place, consisting of stable manure and tree-leaves. It need not be more than two feet in depth, to insure the slight fermentation giving the necessary amount of bottom heat. Upon this, two or three inches at least of good soil is placed, the plants pricked out in rows an inch or two apart, well watered, and covered over with bent sticks, upon which mats are firmly fixed, until they begin to raise their leaves, after which the mats should be removed entirely, except during cold nights and keen cold winds. Ultimately they may be removed altogether, from which time until the young plants are required for finally planting into the permanent trenches, copious supplies of root-water must be regularly given to them.

Trenches should be prepared for the reception of such plants so soon as they have grown five or six inches in height, and before there is any possibility of their receiving a check owing to insufficiency of soil or room. The too general plan is to consult individual convenience, the usefulness of crops occupying the ground whereon they are to be planted, or other circumstances. It is imperative that the trenches be ready for the plants as suggested.

Choose a site whereon the soil is somewhat damp, and of a good, deep, loamy nature. Mark out the trenches, each a foot in width, with intervening spaces of three to three and a half feet between each trench. With a spade dig six or seven inches of the soil out of each trench, lay it upon the intervening spaces between the trenches, levelling it over neatly, and cutting both sides of each trench smoothly and evenly. Now place an inch or two of good manure, thoroughly decayed, upon the soil within the trench, and fork it over deeply, or otherwise, according to the depth of subsoil, breaking it up finely, and mixing the manure thoroughly up with it. The next operation is to dig up the seedling plants carefully; take each into the hands, retaining all the soil possible around the roots, and remove all decayed or injured leaves; lay each on its side upon a hand-barrow, or within a convenient basket, &c. Carry it to the trench, and commence by planting one or two plants with a trowel at one end. Face the trench to be planted; place one foot down firmly on either side of those planted, and proceed to plant others; bring the feet forward in such a way that each is trodden firmly on either side, and so on until the whole row is planted. The plants should be planted four to five inches apart in the trench. Immediately planting is finished, water them in copiously in such manner as to well settle the soil over the roots and around the base of each plant. It is scarcely needful to remark that a rainy period is the best for this operation, or, failing such, the latter part of the day is best. During very hot sunny weather, shading with a few tree-branches, or other mediums, will prove an advantage.

For successional crops, a trench or two should be planted out thus once in three weeks, or at the most once a month. Regular waterings must be given during arid weather, and in such manner that the roots are never short of a proper supply of moisture.

Towards the end of July, and following on in regular succession, the first rows and others will need hoeing carefully along on both sides, the banks having meantime been kept free from weeds. Immediately following, all the lesser useless leaves, and all small side sucker shoots, must be removed. To do this a sharp trowel will often be needed. Having removed such, without in any degree injuring root or plant, hoe the sides along somewhat deeply, and in such manner that an inch or two of the soil will fall into the trenches on both sides of the rows of plants. Then traverse each row, collect the leaves of each plant into one hand, and draw the loose soil up around it with a trowel held in the

other. A good root-watering given immediately afterwards will be very beneficial. At intervals of about three weeks loosen the soil on both sides of the trenches with a fork, break it up fine, and with a spade push it down to, against, and around the plants. Follow with the trowel as before advised. At each earthing up, from this time onward, place about four inches in depth of soil against and around the plants, taking care to keep the leaves straight, and to give room for the growth of the young leaves at the hearts, else will the centres be doubled down, and the sticks form the crooked shape known as "seated." Some, however, prefer earthing up the plants all at once instead of progressively, and excellent Celery is grown on this method.

At the last earthing up, there will be needed about six inches or more depth of soil; after this has been neatly placed around the apices of the plants, again go along each row, and draw the surface soil tightly up to and around the leaves, pressing it so firmly that air cannot enter downwards to the hearts. Without this precaution, the blanching process will be long and tedious. Each successional batch must be treated similarly to above in regard to the earthing-up process; the final earthing up to be done about one month before any are required for use. At the approach of winter place a little additional soil against the sides of all late small trenches, and should severe frost follow, it is well to place a row of stable litter or straw along the tops of the mounds, so as to be a protection to the leaves, and to deter the frost from travelling downwards to the injury of the hearts.

The Celery-fly (*Tephritis onopordinis*) has been extremely injurious to this crop of late years. As a preventive, it is well to sprinkle a little soot over the leaves occasionally when they are covered with dew in the months of June and July, that being the usual time when the fly deposits the eggs which give birth to the maggots within the leaves. Later, and when the maggot appears, little good can be done, though some have resort to picking off the injured parts. All symptoms of it should, however, be removed and burned when the crop is taken up for use, as the progeny are known to hybernate around if not destroyed.

The varieties usually cultivated consist of both red and white examples. The white is best adapted for the earliest cropping, being somewhat more amenable to summer culture and blanching. Bibby's Defiance and Pengelly White, Clarke's Defiance, Leicester Red, and Clayworth Prize Pink varieties, are all good.

Celeriac.

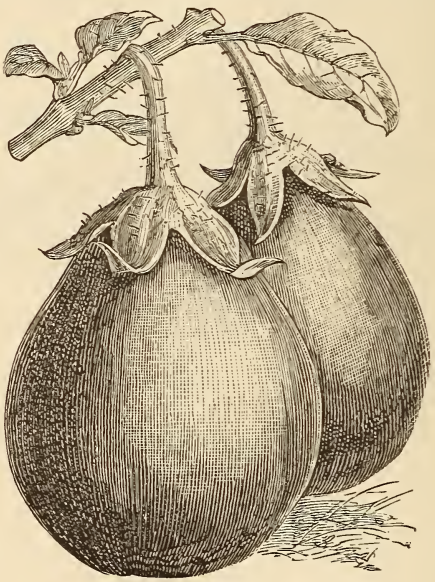
Celeriac (Turnip-rooted Celery). French, *Celeri-rave;* German, *Knollsellerie.*—This variety of *Celery*, which forms an enlarged root-base on the surface of the ground, requires no earthing up. Sow and treat precisely as for Celery until the final planting out. Then prepare a bed of soil deep and well enriched with manure, and plant the plants out therein at distances of about fifteen inches apart. Hoe amongst them as necessary during the summer to keep them free from weeds, and water freely during all dry-weather periods. The crop is fit for use during September and October, and must be protected from frosts, when they occur, should a portion remain unused until then.

Cucumber.—This favourite vegetable and salad is reserved for separate treatment.

Egg-plant (*Solanum Melongena*). French, *Aubergine;* German, *Eierpflanze;* Spanish, *Berengena.*—As the Tomato is so gaining in popularity, the Egg-plant, similarly a fruiting plant, and somewhat identical in the matter of use, is not unlikely to have increased demand, being so generally grown across the Channel. A native of Africa, it is nevertheless moderately hardy. Seeds sown during March and April, and potted on as needful until about a sixteen-size pot has been reached, will insure their fruiting pretty freely therein. In like manner, plants grown upon a hot-bed within a frame, which should be entirely removed during the months of June and July, prove successful. Young plants potted off singly into small pots, transplanted against a warm

sunny wall, about June 1st, also fruit during favourable summers. The fruit consists of many colours, in separate varieties.

Endive (*Chicorium Endivia*). French, *Chicorée;* German, *Endivien;* Spanish, *Endivia.*—This is a hardy annual introduced long since from China and Japan. Owing to the more succulent leaves of improved forms, it has become less hardy than of yore; hence only the very smallest plants withstand the severity of our ordinary winters. Used generally as a salad plant, it is nevertheless in demand for culinary purposes. It can only be grown well under very generous treatment. Good, deep, well-manured and well-worked soil is an essential therefore. The best crops are those of autumn, winter, and early spring. During the summer months heat and aridity force the plants out of heart into the seeding state. The first sowing should be made upon a rich warm border early in April. Transplant the seedling plants, leaving only a thin crop to remain upon the seed-bed to fully develop, at distances of about five inches apart. Hoe well amongst them, giving an occasional watering with liquid manure. Transplant the "drawn" seedlings on to a cool rich border in rows nine inches apart. Plant them deeply, by which means a better heart will be formed. Make a second sowing about the middle of May upon a cool rich site. Sow the seeds thinly, as at this time seedling plants should not be transplanted. Thin this crop out, permitting the plants to develop upon this extended seed-bed. For the autumn and winter supplies, sow about July 20th, and for successional crops once a fortnight subsequently until the end of August.



Black Pekin Egg-plant.

Immediately any seedlings are large enough, transplant them at once into deep rich soil, and a sunny aspect, leaving sufficient upon each seed-bed to continue growing into the perfect plant. The produce of the two last sowings transplant in rows thickly across any warm border at the foot of a wall or fence having a sunny aspect. Here they will stand through the winter, and prove useful for the early spring supply. For autumn sowing a part of the seed sown may consist of the Batavian variety, having smooth leaves, which are more hardy than those of the curled varieties.

To prepare any crop for use, judge when it has nearly attained to its prime; then tie the leaves all up tightly together to enclose the centre, or place a black slate over each plant, so that it lies flatly on heart and leaves. Each process will blanch the centres of the plants, when they will be fit for use. Hence such quantities must be tied, or slated, in succession, as will furnish the needful supply in a state fit for use.

At the approach of frosts, late in autumn, take up and place in pits or frames as many of the larger-sized plants as possible. Plant them in soil deeply, holding the leaves tightly around each plant whilst doing so. Where the convenience of frames or pits does not exist, such large plants may be buried up to within an inch of the apices of the leaves, so drawn together around the hearts, in dry mould in a shed or similar outhouse. The best sorts are Green Curled, and the Batavian is as good a form as procurable.

Amongst curled varieties, Earley's Digswell Prize, Large Ruffec, and White Curled are best, Fraser's Batavian being the best broad-leaved.

The Chicory of commerce is often grown in gardens as an aid to winter salads. As this belongs to the same genus as *Endivia*, being the variety of *Cichorium* having the specific name *Intybus*, we refer to it in this place, but its culture has been already described at page 54.

Leek (*Allium Porrum*). French, *Poireau;* German, *Lauch;* Spanish, *Puerro;* Italian, *Poro.*—The Leek is a hardy biennial, and a native of Switzerland. Its introduction dates back as far as any vegetable. Though grown very generally in gardens of some extent, it is not so generally grown in small English gardens as from its hardihood and merit it deserves to be. The gardens of Wales and Scotland, nevertheless, make up for this, as there it is all but invariably met with. Its culture is of the simplest. Sow seeds upon an open airy site, if possible with a dry subsoil, in soil heavily manured, any time after the first week in March. The seedling plants when

large enough to handle well, having three or four leaves, should be transplanted on to another bed of equally rich soil, and in rows about ten inches apart; the space of five or six inches being permitted between the plants in the rows.

Where it is desirable to grow very fine examples —and it is always best to make the attempt—a better way is to make a shallow trench precisely as for Celery, only do not take out more than four or five inches of the soil. Then dig in an inch or so of very rotten manure, level the surface over, press it down with the foot, and plant the seedlings therein in two rows, in such manner that each plant in opposite rows be at angles with the other. Keep free of weeds during the whole summer, and water freely during dry weather.

Towards the end of the summer, and after a goodly growth has been made, place a mulching of fine manure between the plants, and hoe a little of the soil from the sides of the trench down on to and over it. Give another good watering, using manure-water if possible, and the crop will advance rapidly in size, becoming somewhat blanched at the base preparatory to use. There are certain improved sorts, and the Musselburgh, Ayrton Castle, Henry's Prize, and the Carentan are best.

Ever-White Curled Endive.

Lettuce (*Lactuca sativa*). French, *Laitue;* German, *Lattich;* Italian, *Lattuga;* Spanish, *Lechuga.* —The Lettuce is a hardy annual, the origin of which is buried in some mystery; whether a sport from our other native species cannot therefore be determined. It is of free and easy culture, luxuriating in the richest of loamy soils, wherein its seeds freely germinate, from which seedlings the crisp hearts proceed. It is more especially an early summer and autumn plant. The heat and aridity of moderately dry summers too generally hurry its growth into flowering and the seed form. Those who would secure fine produce must, therefore, give their attention especially to crops produced during these seasons of the year.

Two grave errors are far too generally perpetrated in connection with Lettuces, *i.e.*, they are too often treated as a subsidiary crop to other kinds of vegetables, and are sown too thickly in seed-beds and grown too thickly together. Always where possible set a portion of the garden, however small, apart for them. Not only should the soil be mellow, deep, and highly enriched with manure, but it should possess also full exposure to sun and air, with perfect drainage.

These secured, successional crops, constant and in season, will be guaranteed by sowing the first small seed-bed towards the end of the month of March. At the same time it is good practice to sow a large wooden box with seeds, to encourage germination and early growth under glass; a cold pit or frame being excellent for this purpose. So soon as the young plants have three or four leaves, and are fit to handle, draw the largest out carefully, and transplant thickly together in nursery-bed fashion, again planting them out in rows from twelve to fifteen inches apart, and about ten inches apart in the rows. To steady and aid the young plants, a shallow drill-row might be drawn along, in which to transplant them.

Being very subject to slugs, a slight dusting of lime towards evening occasionally will be a deterrent and great aid. Having well thinned out the plants in the seed-bed, leave a sufficient number thereon to grow to maturity, hoeing well between them to give them free soil around and a start into growth.

Make successional sowings regularly one month after the other until the early part of July, treating the seedlings in all but the June and July sowings as advised above. For those early sowings Black-seeded Brown Cos and Cabbage varieties may be sown, but for the latter any form of White Cos of the Brighton or Paris Cos types should be made.

These last sowings must, however, be made so thinly as to allow of the plants growing and standing till maturity where sown. To transplant them will be to cause the plants to go hurriedly to seed. When the seedling plants secured from these last

sowings are large enough to grow alone, thin the rows of seedlings out to twelve inches apart, hoe freely amongst them, protect from insect attacks, and as growth progresses give one or two good waterings. By these means they will make a rapid growth, heart-in freely, and give every excellence in the form of superior produce. The Cabbage Lettuces need not be thinned out to more than eight or nine inches apart.

To secure the autumn crop, make a sowing of Black-seeded Brown Cos during the second or third week in July, choosing cloudy or rainy weather if possible. Should the weather prove continuously dry, the sowing must be made during the latter week, and the seed-bed kept constantly moist by watering and shading until germination takes place. Other small sowings for succession make once every three weeks until early in the month of September, when an additional sowing of Hammersmith Hardy Cabbage Lettuce should be specially made.

The seedling plants resulting from these sowings —the two earlier ones especially—must, so soon as large enough, be transplanted and grown on precisely in the same way as recommended for those above; the difference being that, as any successively become large enough for use, they must be tied up by twisting matting around to cause the hearts to blanch. Unlike the White Cos, they are not so readily self-hearting. Ultimately, as winter approaches, some of the seedling plants formed of the last sowing, though scarcely large enough for transplanting, must however be drawn and dibbled out in rows thickly upon a warm sunny border, with a south aspect, to stand through the winter for rapid growth in the early spring following; and these, it will be found, will be conveniently associated with the late sowings of Endive before referred to. Some of the smaller seedlings remaining in the seed-beds after process of transplanting, allow to stand therein during the winter. These, along with every other or alternate plant of such as have been transplanted thickly to stand the winter, may be taken up carefully next spring following, and transplanted to come in succession after the earliest ones from which they are taken, to give the latter more space to grow.

All seedling plants intended thus to stand the winter in the open ground must be occasionally hoed, even during the winter months, should a dry fine period permit of it.

For the mid-winter supply, all the largest and finest plants existing in the open ground must be taken carefully up, and planted thickly into pits or frames, where they can, pending use, be protected from severe frosts. A few of the most forward next in succession, still remaining in the open ground for want of room, place a little litter over, and so soon as room is made, by the use of such as are in the frame, for a further addition, take these up and refill the pit or frame with them. The Cabbage Lettuce recommended above will give an excellent first crop of white hearts out of doors, after winter and the colder months of spring are passed.

The best varieties for winter use are Black-seeded Brown Cos, Bath Sugar-loaf, Nonpareil, Hicks' Hardy White, Fulham White, and Hardy Hammersmith Cabbage. For summer use, Cooling's Leviathan Cos, Paris White Cos, and Vauxhall Defiance, All the Year Round being a good form of the Cabbage type.

THE ROSE AND ITS CULTURE.

By D. T. Fish.

PROPAGATION BY CUTTINGS.

THERE are several seasons and methods by which this may be accomplished, and the time of rooting Roses by cuttings has of late years been extended from March to November. The first and oldest method is by

Dormant Shoots.—As soon as the leaf falls, or just before, cuttings of all sorts of Roses may be put in with almost as little trouble or skill as those of Gooseberries or Currants; and though they will not root with equal uniformity, yet a great many of them will strike, as the rooting of cuttings is technically called. The cuttings should be about a foot long; the wood of medium strength, and well ripened. Each should, when practicable, be taken off with a heel, that is, a small portion of older wood than itself at its base (Fig. 16, *a*). The best cuttings are those made of the wood of the current year. They mostly root best when simply dug into a quarter or border in the kitchen garden; this consists in digging the ground as the work proceeds. A good plan is to insert a double row of cuttings at intervals of two feet between them. Some, however, put them in single rows, at distances of a foot or eighteen inches asunder. Having dug over a few spits of ground, stretch the line across the dug portion, and cut out a trench four inches deep; place the cuttings along the edge of the trench; apply about half the soil; tread the cuttings in firmly with the foot, pressing them also against the edge of the trench

Fig. 16.—Dormant Rose-shoot, with Heel, cut back.

in the process, to give them vertical and horizontal solidity. Then raise the ground up to the level of that already finished (Fig. 17). Then commence digging another spit, and digging the distance between the rows, proceed to cut another straight edge or trench; insert, partially cover, and tread in the cuttings as before, and so on till the whole are planted. Should very severe weather ensue, a few boughs or a little common bracken may be placed over the cuttings; but, as a rule, nothing whatever will be needed, as the majority of Roses will withstand the severities of our ordinary winters with impunity. Some insert the cuttings so deeply as to leave but one or two buds above ground; others leave four or six. The first place two-thirds or more of the cuttings under ground. This has some advantages, as if the surface buds are destroyed others are almost sure to break from under the surface. Some are careful to disbud all the buried portion of the shoot. This is labour lost, if nothing worse, for as all the shoots that may come up will be Rose-shoots, the more of them the better, and the more roots will be formed.

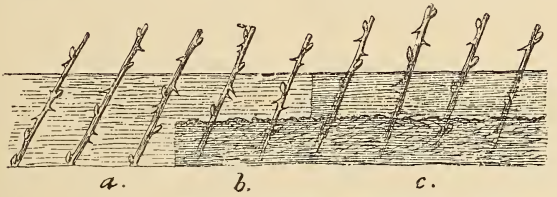


Fig. 17.—Dormant Rose-cuttings, showing mode of placing them—in by the heels at *a*, half covered at *b*, and wholly filled in at *c*.

Striking Growing Shoots. — This may be done in three ways—by cool treatment in the open air; by warm, close treatment under glass; and by a mixture of both. Rose-cuttings in leafage (see Fig. 18, showing cutting with a heel at *a*) should be placed on a shady border to root them successfully in the open air in June, July, or August. The cuttings should have heels (*a*), and be in a condition of semi-ripeness. About half the length of the winter or dormant cuttings is also generally thought sufficient, two leaves, or even one, being as many as the cutting is likely to keep fresh or green in the open air at that season.

Fig. 18. — Same Rose-shoot as Fig. 16, started into Leaf.

They are often covered with hand-glasses or cloches to preserve the leaves, which may prove of the greatest importance; but if once these are applied they cannot well be dispensed with until the cuttings are rooted. On the whole, success is greater without them. A few overhead sprinklings per day for a time are useful, and if the leaves can be kept green for a week or so, the cuttings will have begun to callus, and are safe. A little sand placed at their base when inserted favours the rooting, and is a good practice. Such cuttings should be left where they are till the succeeding spring or autumn; or should they root early, and be of Tea or other tender varieties, they may be taken up and potted within three months of the time of their insertion.

Striking Summer Cuttings in Heat. — The cuttings in this case need not be so ripe as in the other. They may also be shorter, from three to five inches being long enough. Hard and firm planting is equally or more important than with the other classes of cuttings. Insert in pots or pans, or on a hot-bed, with a bottom heat of from 60° to 70°. Either cover the cuttings with bell-glasses or keep the house or pit tolerably close. If the former, wipe and tilt up the glasses every day, seeing that no mildew or damp settles upon or injures the leaves.

Keep these as well as the shoots growing until roots are formed. So soon as this takes place, gradually give more and more air, and reduce the temperature to the natural level; or the plants may be potted off when rooted, and pushed on under semi-tropical conditions, making the growth of almost two seasons in the remaining portion of one. When this plan succeeds, it is doubtless the quickest of all methods of rooting Rose-cuttings. But it not seldom illustrates the maxim—"The more haste, the less speed."

The Mixed Cold and Warm Method.— This consists in the making and inserting of the cuttings in the usual way in pots, pans, or boxes, as portability is essential to the success of this method. Insert the cuttings, and place them in close cold pits or frames, shading them from direct sunshine for a fortnight, three weeks, or a month—until, in fact, they begin to callus.

So soon as this occurs, remove them into a brisk bottom heat of 65°. The roots will spring forth at once, and within a fortnight of their being subjected to a warm regimen the Rose-plants will be fit to pot off. Return for a week or ten days to their warm quarters, and gradually inure to green-house or open air before the end of the season.

This mixed method and the first, that of inserting

dormant shoots in the open air in the late autumn or early winter, are the best for the sure rooting of Rose-cuttings. Some years since, a Rose-secret was written about rather freely, that promised to convert every shoot and twig into a Rose-plant, as if by some magician's wand. It is needless to remark that that secret has not yet been revealed. It is probably, however, fully two-thirds opened to those who have carefully followed us thus far through the propagation of the Rose. Each eye, as we have already seen, may be converted into a plant, and some have affirmed that every leaf and even leaflet may be made to root. But as there is no record of the leaves growing into Rose-bushes, it is not needful to go further into the matter. One of the easiest of all seasons to root Roses has, however, yet to be adverted to, and may be most conveniently discussed under the head of

Spring Cuttings.—Since the forcing of Roses has become general, it is obvious that quantities of Roses will be found under glass in February, March, and other early spring or summer months, with their wood in similar condition to that of out-of-door Roses in June, July, or August. The wood is found in practice to be in even better condition for rooting than that from the open air. Cuttings of forced Roses, or from those grown under glass, seldom fail to root freely. They bear warm forcing treatment with less risk than any other Roses.

Were this true of Teas only, it might be easily explained, but it applies to all sorts and conditions of Roses grown under glass, and the fact is of the utmost practical value to the rapid multiplication of Rose-plants by cuttings.

So soon as the flowers fade is the best season to insert what are called here "spring cuttings." The name is about all they differ in from other cuttings, unless, indeed, the better climate in which they have been grown has endowed the plants with greater vital energy, as well as inured them to the higher temperature favourable to the emission of roots. Be all that as it may, no cuttings root so freely, with such a small percentage of loss, as those of forced and other Roses put into heat in the spring. One strong argument in favour of rooting Roses at that season consists in the fact that they have all the summer before them to grow into plants. The cuttings also root sooner in the spring than at any other season. Hence, if inserted say in February, they may be rooted, shifted into single pots, grown into considerable size, hardened off, and planted out by the end of May to furnish a good crop of bloom before the end of the year. The roots of Roses may also be converted into cuttings, and become good plants. But as they are more trouble, and in no respect better than those already described, it is not needful to advert to them further.

Nothing has been said about compost for cuttings, as it is not material to their rooting. Cuttings need nothing, and can indeed absorb little else from the soil than water; and this in plenty, but not in excess, is all they require until roots are formed. Very sandy soil, or pure sand, is consequently the best rooting medium for Rose-cuttings. So soon as rooted they become Rose-plants, and no soil can well be too good for them.

PROPAGATION BY GRAFTING.

This differs from budding in the fact that it generally means the union of two different woods as well as of bark, and that the foreign scion inserted in the stock is much larger than a bud, and generally consists of a considerable section of wood with two or several buds. The art of grafting differs, however, but little in principle from that of budding. Larger masses are concerned in it, and hence the modes of manipulation vary, but the uniting forces are still the same. And these can hardly be said to be the wood, but the sap, the cambium or young growing tissue, the bud, and the bark. It is of importance to bear this in mind, or failure in grafting is almost sure to ensue. It matters less about the mere size of the scions, than the close fit of the inner barks of the scions and the stocks. Tyros in the art of grafting will please to note the word "inner." The outer bark is little more or better in regard to grafting than a mere covering. It has little more life than the paper wrap round a parcel. The inner bark is the source of life, where the growing tissues are situated—the only active agents in effecting the union between the scion and the stock.

Condition of Stock.—The stock should have started into root, and, less prominently, into top growth. The exact amount of leaf-development in the stock most favourable to the union of the scion varies in particular plants. The Rose, for example, need hardly have started; the Grape-vine must be in full leafage, otherwise it would bleed to death. In all cases the root should have started, and the sap be on the move, if not in full circulation.

This is, however, not seldom set aside in practice. Stocks are dug up, or received from the nursery, and grafted at once without more ado. The manipulation of a few stocks in this way is much easier than that of potted plants. This practice, however, though occasionally successful, is not to be commended or approved. Such stocks should be placed in heat for a fortnight or so before use, after which they may be worked in this free-and-easy manner with every prospect of success.

The Potting up of Old Growing Stocks for a Year before Grafting.—This is, no doubt, the safer practice; and thus having them under complete control, they may be placed in warmth and got into that exact state and condition most favourable to promoting a speedy union with the scion.

Best Stocks.—Among the conflicting claims of seedling briars, briar-cuttings, briar-roots, Manetti, De la Grifferaie, Boursault, Banksian, and others, it may seem presumptuous to decide. And yet there is little doubt that the Manetti, briar-cuttings, seedling briars, and the standard briars, form the best of all stocks on which to graft Roses. (See previous chapter on Stocks.)

Of late years the seedling briar has had almost a monopoly for some classes of Roses; Teas especially have been held to bloom more freely on these than on any other. And no doubt they are most useful, especially for whip grafting, in which the scion and the stock should be of equal diameters. The writer has also been very successful on the roots of the Dog-rose. These were dug up, cut into six-inch lengths, placed in bottom heat, and grafted about three weeks afterwards; and ninety per cent. grew, and did well.

Condition of Scion.—The scion should be dormant, and at least a fortnight behind the stock in regard to its vital condition. Nothing is more fruitful of failures in grafting Roses than the use of scions already bursting into leafage. These leaves and embryo shoots are either withered up before the union takes place that would send forth supplies to preserve them, or they exhaust the scion of those fluids that could have united it to the stock. The dormant scion avoids both these dangers, its buds moving little, or not at all, till the union is partially completed, at which stage the action of the leafage becomes a powerful auxiliary in cementing the union of the scion with the stock.

Ripe Wood as Essential for Scion as Dormancy.—Ripeness, firmness, a certain degree of solidity, are needful to sustain the life of the scion during its interregnum of separation from all other sources of life but itself. Hence the bases of Rose and other shoots are best for scions as well as cuttings. The tops are soft, spongy, and full of watery sap, and should never be chosen for scions. The sun and air soon dry up the juices, and wither up the bud, rendering the growth or taking of the scion impossible.

Length of Scion.—This is of comparatively little moment, although, of course, within certain limits, the longer the scion, the greater the risk of failure. Neither is there any advantage in having scions too long, from four to seven inches being mostly long enough. The actual length is, however, very much determined by the distance between the Rose-buds, and this varies greatly. Two buds on the head of the scion, and one somewhere in the length, or at the base of the uniting part of the scion with the stock, will mostly be found sufficient; the reason for cutting through a bud on the uniting parts is that a larger amount of nutriment, and a fuller development of growing tissues, are to be found in close proximity to the buds, and hence, when the bud is removed or suppressed in tying, this living, binding force finds expression in hastening the union between the scion and the stock.

Time and Place to Graft.—January and February are the best indoors, March and April outside. The latter, however, is scarcely ever practised, unless in the case of grafting standards, a practice almost wholly superseded by budding. Still, when and where the grafting of briars in the open succeeds well, almost a year's start is gained over budded Roses.

But grafting in the open air is rather precarious, and as grafted Roses are seldom so long-lived as budded ones, the two woods often refusing to blend into one durable healthy plant, this method of grafting is but little practised.

Different Modes of Grafting. — Almost any of the methods of grafting to be set forth in our articles on Propagation may be used for Roses. Yet it is found that different methods are best adapted for different species of plants, and only three of them are much used in the propagation of Roses. These are whip or splice, cleft, and crown grafting. The first and the last are the best, though cleft grafting with the modification of it called saddle grafting are also used.

Whip or Splice Grafting.—These terms almost explain themselves. In tying the two fragments of a whip or cord together, the union is called a splice, and it is thus performed:—Each of the two fragments is reduced to one-half of its diameter along a distance of, say, three or four inches, the ends of each part terminating in a thin wedge; the two are then firmly bound together, and the whip or cord is made as strong as it was before. Of course, the splice is most perfect when the two pieces are of the same diameter. This is a mechanical splice. In grafting, our ultimate object is to force nature into making a vital splice between the parts.

Our first steps, however, consist in the equal

sloping and firmly binding together of the scion to the stock, exactly as in splicing a broken whip.

To make the union the more perfect, sound, and durable, these two should be of equal diameters. Thus each part fits to the corresponding part, wood to wood, cambium to cambium, bark to bark, all round. The more perfect the fit, the more speedy and sound the union.

Cut the stock across at the height desired, then place the graft against its side, an inch or an inch and a half from its crown, take the measure with the eye, and make a clean diagonal cut across the stock from the required spot, tapering almost to a point on its top. It is most important that this cut should be

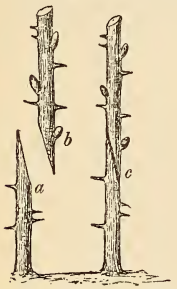


Fig. 19.—Whip or Splice Grafting. *a*, stock; *b*, scion; *c*, the two united.

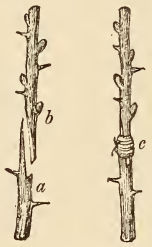


Fig. 20.—Whip or Splice Grafting, with Tongue at *a* on stock; *b*, scion; *c*, the two united.

clean and smooth, tapering equally all the way. Having already taken the scion in hand, proceed to cut it in the same way, making the cut the exact counterpart of that on the stock. Then, without a moment's delay, place the two fresh-cut surfaces together, and bind them tight with bast, cotton-wick, or other ligature, and the mysterious art of grafting is completed. If the fit be good, and the inner bark of scion and stock impinge against each other along their lines of contact, success is almost certain, otherwise failure is even more sure. This is the simplest mode of whip grafting, and is as good as any other.

Whip Grafting with Tongue.—This consists in forcing portions of the wood of the scion into the stock, and *vice versâ* if desired, for there are modes of double as well as single tongue grafting. Our illustration will explain this better than any amount of description (Fig. 20). But as it increases the trouble, and does little or nothing to accelerate the union or make it more certain, it need not be further adverted to here.

Crown Grafting.—In this method the scion is prepared in exactly the same manner as for whip grafting. The wedge may be longer or shorter as desired. The top of the stock is also squared in the same way, but the wood is all left intact. A slit is then made down one or, where the stock is larger, two or more sides of the stock, and the bark slightly raised as for budding; the wedge portion of the scion is pushed into the slit, bound firmly into position, and the process is complete. There are, however, many modifications of this mode of grafting, though this, of which an illustration is given (Fig. 21), is the simplest and the best.

Fig. 21.—Crown Grafting. *a*, the stock; *b*, the scions.

Cleft Grafting.—In this also the preliminary preparation of the stock may be broadly affirmed to be the same as in the others, that is, the head is cut off. Beyond this the mode is considerably different. The simplest method of cleft grafting is that in which the stock and scion are of about equal diameters. A wedge-shaped piece of wood is then cut out of the stock, the scion is cut to fit this V-like cavity, placed in, and bound in position. This mode, however, is often practised when the stock is much the larger; in that case a piece of wood is cut out of the side of the stock, the scion is manipulated to fit in quite level with the bark, and the process is complete (Fig. 22).

Saddle Grafting.—This chiefly diverges from the above in the following manner. Instead of the scion being cut into the form of a wedge through-

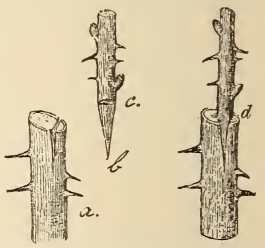


Fig. 22.—Cleft Grafting. *a*, stock; *b c*, wedge of scion; *d*, the graft made.

out, it terminates within a quarter or half an inch of its natural termination at the upper end. This is then cut up straight, leaving a projection from the inside of the cut to the outer bark. This projection enables the scion to rest upon the crown of the stock in a similar manner to a saddle on a horse's back, and hence the name. This form may be of some service in imparting greater stability to the scion, and, in so far as the projecting portion of the scion helps to clothe the crown of the stock with new bark, it is of great use. But as to hastening the union between scion and stock it is probably useless, or worse, as during the time spent in manipulating these rather complicated scions so as

to make them fit perfectly, the most potent uniting force, the fresh, sweet sap of the Rose, is being dried up and wasted. Nothing can compensate for this loss, and hence smart manipulation, a good fit, and instantaneous tying are the surest roads to success in Rose-grafting.

Cleft grafting is the mode most generally practised in the open air; as the standard briar is almost the only stock used, it is perhaps, on the whole, the best for this purpose. Success would be indeed far more sure and uniform were the briars, of whatever height, potted up in November, and wintered under glass. Or borders could be made for them in cool houses in which they might be packed closely, in rows of from three to six or more abreast, with sufficient space between to reach them from either side. A gentle warmth of from 50° to 60° might be given in December, the stock could then be worked with scions from the open air in January, and the Roses be fit to plant out in the open quarters towards the end of May. By these expedients most of the risks and discomforts of grafting Roses in the open air in March would be avoided, and the chances of success greatly increased.

Exclusion of Air and Water.—The old-fashioned mode of doing this was by plastering over with prepared clay that hardened into a waterproof mass. But this simple and preventive method has seldom or never been used for Roses, inasmuch as it had been superseded by various sorts of grafting-wax, before the grafting of these became fashionable. And now the horticultural sundries men, who undertake almost everything for cultivators, advertise all sorts of grafting-waxes or ointments, most of which are tolerably efficient. The danger and fault of most of them consist in their being used too hot, and setting too hard. To prevent the former, thrust a finger in before use. If not too hot for that, it will not injure the Roses. A small percentage of tallow is one of the surest antidotes to a cement-like hardness. A cheap and excellent grafting-wax for Roses may be made by warming over a slow fire three-fourths of common pitch, with another fourth consisting of equal parts of resin, bees'-wax, and tallow. Apply, after testing and proving sufficiently cool, with a worn-out painter's brush, laying on the mixture thickly over the crown of the stock, and smearing the tie all over, and a little above and below the point of union. This when cool will prove quite air and water proof, and so keep the wound hermetically sealed, one of the greatest aids to its rapid healing, and consequently the union of scion and stock.

Dwarf Roses grafted in-doors are seldom waxed or cemented over. By working these low down the stems, or even on the roots, the spliced portion may generally be more or less covered over with earth, and thereby be kept in good condition for forming a sound and healthy union. There are also other advantages in thus grafting close to or on the roots. The scion, as a rule, under such conditions forms independent roots of its own, which very often finally supersede the roots of the stock. In such cases the latter serve more of a temporary than a permanent purpose. They support the scion to form a union with the stock, and help it to form roots of its own, and then disappear, or sink into a condition of secondary importance.

But of course in the dwarf standards, or even dwarfs, worked a few inches above the ground, this mode of burying the point of union, and borrowing the roots of the stock for a temporary purpose, cannot be adopted, and all such grafts may be waxed over in the usual way. This, however, may be safely dispensed with when the plants are grafted in a moist atmosphere, and kept in heat and moisture till the scions have taken.

Sometimes the wax sets so hard that it needs considerable force to remove it. Great care must be taken not to disturb or displace the scion in the process. Should the ligatures not have rotted, they must be removed. If the union is complete, all is well; if not, give a second tie, and keep the scion firmly in position, and prevent the slit in the bark from opening.

PROPAGATION BY LAYERS.

This process consists in forcing the branches to form roots while still fed by the parent plant. It is one of the oldest, simplest, surest means of propagation. It can only be practised on dwarf, climbing, or weeping Roses, and the latter must droop so far as to touch the ground. But as all Roses do not root with equal freedom, there are different modes of procedure. Some merely thrust a spade into the ground at a convenient distance from a dwarf Rose, remove a large spadeful of earth, bend a Rose-shoot into the hole, place the earth on the top of the shoot, stamp it down firmly, and thus finish layering. (See Fig. 24.) Others make a deep slit, by thrusting in the spade, moving it backwards and forwards, place the shoot in the slit, and tread it firmly in. A stone is frequently placed on the centre of the shoot, to make all more secure. A third plan insures greater stability, and lessens the risk of disturbance until safely rooted, by the use of wooden or wire pegs thrust down over the shoots to keep them immovable until rooted. These are what may be called the more rough-and-ready modes of layering Roses, and they answer fairly well for most of the free-rooting varieties. But many of the more choice Roses root

very slowly or not at all by such means. For these, and also to insure the more rapid rooting of all Roses, the following mode of layering is the best.

Layering with a Tongue. — By this mode the cultivator combines most of the more solid advantages of propagation by cuttings, while retaining the safety and security of layers. The branch is cut half through at the base of a bud, and cut up its centre for an inch or more in length (Fig. 23). A small stone, or a little earth or sand, is then placed in the slit to keep it open, and the layer is thrust into the ground, the upper part of the branch being so placed that its half-diameter with base-bud is

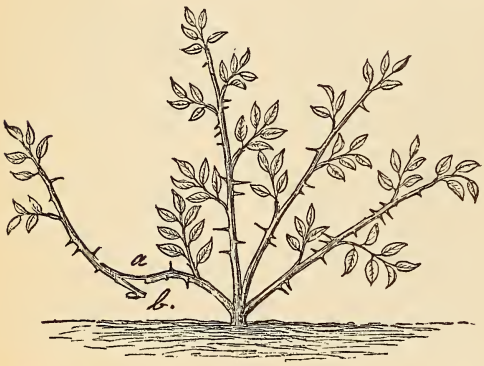


Fig. 23.—Layering with a Tongue. Tongue at *b*, and mode of forming it at *a*.

placed in a semi-vertical position in the ground. To make all this more sure, and to insure perfect immobility to the rooting portion, the upper end of the layer is fastened to a stake (Fig. 24), the branch being also pegged firmly. With such manipulation of tissues, and presentation of the root-forming portions of the plant to the soil, it must and does root freely, and without risk, as during the whole process the branch is still supported with food through the unsevered portion of the stem.

Size and Length of Layers.—This is not material to their final rooting. But to propagate Roses in quantities from layers, the young wood of the current season is the best. The choice of such will keep the layers small, leaving only a few inches above the ground. The wood must also be tolerably firm, or there will be much risk of rotting. Of course, where larger branches of two or more years old wood are used, there will be no such risk.

Time for Layering.—Any time during the growing season will answer, but practically from the middle of June to the middle or end of September will be found the best season to insure rapid rooting.

The first layers may often be removed in the same autumn, others may remain till the spring, and any not rooted till the following season. They are mostly well rooted, and form among the most valuable of all the varieties of own-root Roses. Sometimes not only will the layer be found to have protruded roots from near the base of the buds, but the whole of the branch portion of the slit will also become callused, or even full of roots. In such cases this should be cut off intact, and either left as one rooted layer or divided into many. Planted out

Fig. 24.—The Layer Staked and Pegged down.

in nursery beds or, better still, placed in heat, these layers or partially-rooted sections will produce one or many Roses apiece.

PROPAGATION BY SUCKERS.

The suckers of Roses are underground stems, running almost as far as those of wilding briars, and being at times nearly as troublesome as Spear-grass. They can hardly be called roots, and many of them, while attached to the parent plant, seldom or never form roots. If left, however, to form more or less top, and then removed from the plant, placed in light sandy soil, partially shaded, and carefully nursed for a time, most of them will produce roots. September and October are the best months for this mode of propagation. The suckers should be carefully traced back from their growing stems till their exact positions on the root-stocks are found. Then remove them with a strong knife or sharp trowel, taking a small portion of the root-stock with them. Of course, if found to have roots this precaution is not necessary. Very few really good Roses, however, are at all fruitful of suckers, consequently this mode

of propagation must not be much relied upon. It is also found that Roses raised from suckers are apt to run to suckers more freely than is consistent with symmetrical growth or floriferous habits, the suckers being also apt to produce "gourmands," that is, abnormally strong and spongy shoots, which not seldom starve off the better or freer-flowering portions of the Rose. No Roses, unless it be some varieties of the Scotch, approach the Dog-rose or briar in the prodigality and persistency of their suckers.

PROPAGATION BY ROOT-DIVISION.

This is only practicable in the case of comparatively few Roses, such as Chinese, Scotch, Austrian Briars, and a few others. These spread out into bushes rather than retain the character of individual plants, and each branch division of the bush has its own independent roots, similar to a herbaceous Phlox, Pæonia, or other herbaceous plant. Such Roses when lifted may be divided into as many plants as there are rooted stems. Examining a very old plant of Coupe d'Hébé, as this is being written, it has as many as half a dozen independently rooted divisions, and, of course, could be readily divided into so many plants. But this mode of propagation is but little used, and mostly confined to the China or Fairy Roses, the old red and pink Monthly Roses, and *Rosa spinosissima*, or Scotch.

The early autumn is the best time to propagate hardy Roses, and about April the more tender ones, by root-division. Fairy Roses in pots may be divided at any time, the plants being quickly re-established in a close pit or frame.

Occasionally a good many other dwarf Roses will manifest this property of root-spreading, and any such may be divided as opportunities of removal or transplantation occur. However, as root-division is the last mode of Rose-propagation mentioned here, so it is also the least useful, and it has been but little practised since the budding, grafting, and free rooting of Roses from cuttings have been so generally and successfully adopted.

THE HARDENING OFF OF PLANTS.

IN the earlier part of the summer this goes on in a wholesale way. Not a few gardeners who have only one or two glass-houses, partially or wholly empty them during the summer months. The plants with which they have been crowded during the winter or early spring months, are now placed out of doors, either to add to the beauty of flower-beds or borders, to make or finish their summer growth in the open air, or for the express purpose of being hardened. As all sudden changes are dangerous, and the transition from under glass to the open air must needs be a change more or less sudden, however mild and warm the weather may be, a few words of warning and of guidance in this matter may prove alike seasonable and useful.

Every transference of plants from under glass into the open air is really a hardening process, and needs some judgment and care. The simplest and safest mode of leading all plants from one to the other without their receiving any check by it, is to begin by making the inside as like the open air as may be, some days or weeks before the transference is made. We cannot make nor greatly modify the weather out of doors, but we can under glass; and if the greenhouse sashes and doors are opened night and day, or the glass-frame is drawn off, for a week before plants are moved wholly into the open, they will hardly feel the change, to use the common phrase used by gardeners. This tentative method of bringing the outside weather to bear upon the plants while under glass, enables them to be moved from the one condition to the other without check or hindrance of any kind. To insure this, however, another common mistake must be avoided, and that is the placing of the plants in a too exposed position. Plants under glass have more or less of shelter and shade; yet not a few, in placing them out to harden, set them in the full blaze of the sun, and in the teeth of the wind; consequently, their leaves and stems are either baked by the sun or torn and riven by the wind. Even should they escape such serious injury, they are frequently so violently and severely hardened off, that it is weeks before they again start into growth, if, indeed, they grow any more for the season. The hardening process must be gradual, if it is to be either safe or beneficial. Begun in-doors, carried on a step at a time in the open, it ends by fitting and strengthening the plants for their summer work, or next year's flowering. A sheltered place, shaded from the sun for two hours on either side of noon, is the best possible situation for plants that have just been removed from under glass into the open air. After a fortnight or so the plants will be so hardened as to be able to stand almost anywhere. The time, place, and treatment, however, should be varied with different plants. Some are so drawn up—that is, so weakened and attenuated—under glass, that they need a month's or more gradual hardening before they can stand the noonday sun's broad glare with impunity. Others are of such a character—as Camellias, for example—that the shady side of a wall or fence suits them best throughout the season. Others, again, such as Azaleas, can hardly have too much direct sunlight to

mature the wood and form the flowering buds for next year. Of all plants it may be said that the roots need protection from direct sunshine even more than the tops. More plants perish, of those put out to harden, through the sun beating on the pots or surface soil than, perhaps, from any other cause. Various means are adopted to prevent this, such as a surface mulch of moss or cocoa-fibre refuse, and the plunging of the pots to the rims in coal-ashes, sand, or other substances. The simplest, newest, and for some classes of plants—such as Indian Azaleas—decidedly the best method, consists in planting them out in beds of peat for the summer, placing them so closely together that the whole ground is covered, without the plants being overcrowded. This saves an immense amount of labour in watering, and the plants ripen and form flower-buds with a regularity and profusion scarcely reached by any other system. A good soaking once a week or so in dry weather is almost all the attention they require, and no scale, thrip, red spider, nor other pests, get a foot-hold on the plants under this semi-natural mode of treatment.

As the balls of these plants (see article on Potting) are hard, it is needful, in planting them out, to take the same securities against dry balls as recommended for potting, and the peat or other compost must be rammed as firmly round and among the balls as possible. This system may be called the perfection of hardening off plants throughout the summer months. Early in October, at latest, Azaleas and other plants summered in the open thus must be potted up, a size larger pot being used as a rule than that which they were planted out in.

But for small growers this plan of planting out choice plants for the summer is never likely to be popular, and the best and cheapest imitation of it is the plunging of the pots to the rim in coal-ashes on a worm-proof base, and the mulching over the surface soil of the pots with layers of cocoa-fibre refuse or clean moss.

THE FLOWER GARDEN.

By William Wildsmith.

CARPET BEDDING.

BY this term is meant regular and formal arrangements of dwarf *foliage* plants, both tender and hardy, either alone or in combination with flowering plants. The popularity of this style of bedding has excited a corresponding amount of adverse criticism from parties who can see nothing to admire in anything that does not coincide with their own notions of beauty. It would be uncharitable to accuse such people of want of taste, but their taste is certainly of a curious order, where no "keeping" of lawns, and the just allowing of all flowers to grow at random, or as they themselves prefer to put it, "at their own sweet will," is the professed model of their gardening. This we call at least as great an extreme in the opposite direction, and of the two prefer carpet bedding, which it is possible to carry out with far less of formality than is generally done.

The term of *carpet bedding* is not a good one, but doubtless originated from the table-like flatness which the arrangements were made to assume when the style was first introduced, a mode still practised by some. But a more graceful style is gradually springing up, the stiffness or formality being broken at regular intervals with standard graceful-foliaged plants, so that the term "carpet" is no longer appropriate, and a far better term coming into use is *panel gardening*.

In our uncertain climate the advantages of this method of gardening are immense, particularly during the summer, when it is desirable to have brightness and gaiety, which neither ordinary bedding plants nor hardy perennials insure in stormy weather. Such weather dashes the flowers to pieces, and then it is that foliage arrangements show to the greatest advantage, and maintain their effectiveness long after autumn fogs have destroyed the flowers of Pelargoniums and other bedding plants. But even apart from this advantage, a few such beds are desirable in every bedded-out garden, and more especially in such as are required to be kept furnished all the year round, there being numbers of hardy carpeting plants which look just as well for summer if a few of the brighter kinds (Alternantheras, for instance) be intermixed with them; these giving place in the autumn to other hardy kinds.

Position and Extent.—As regards the position there cannot be two opinions in the matter. The *formal* terrace garden, with its vases, fountains, statuary, and other stone-work, is the rightful place; but all these should be supplemented with good breadths of turf, and a goodly array of shrubs on it, wherewith to break or prevent all excess of stiffness or formality. This might also be accomplished—more particularly in the summer time—by planting, at certain distances, beds of the more graceful and more dwarf "sub-tropicals," which latter plants could be replaced with shrubs for the winter.

Then there is the opposite of this, viz., that a few carpet beds may with excellent effect be associated with other bedding and foliage plants in a less formal garden. Of course the arrangements of the plants in this connection should be of the least formal type. Another good position for such beds and borders is on each side of a straight walk, the

arrangement of plants being varied in each bed, and the unavoidable stiffness of this kind of bedding being relieved by planting between each bed shrubs which harmonise with the formal character of the arrangements.

For adoption on a small scale, even the garden of the typical London villa, with its straight walks, railings, or walls, and grass plot, is exceedingly appropriate; and a bed, or a couple of beds, planted in the carpet style would often be a desirable change from the monotony of Geraniums, Lobelias, and Gold Feather Pyrethrum, which constitute the bulk of the plants used in such gardens.

As to what *extent* carpet or coloured-foliage bedding may be practised in the positions indicated, that must be left to the surroundings, individual taste, and climate. If the latter be cold and wet, one-half of the garden would be none too much for the formal terrace; but good judgment would be essential that the differing styles be evenly dispersed over the entire garden. As remarked, *individual taste* must have a hand in this decision; and those with a weakness for gaudiness will not think of going so far, whilst others may be disposed to go further. But it may be well to warn both that the surroundings should have the strongest voice in the matter. If these be excessively formal, then the beds may be proportionately the same, and *vice versâ;* only the formality here meant should not be understood to be an unbroken flat surface, but foliage-colouring, arranged in simple patterns, with graceful standard plants in central positions. Extent as regards the other positions named must be purely a personal matter. The straight walk position, provided the recommendation as to shrubs is respected, may have all carpet patterns, whilst as to the small villa garden, it must be either all or none.

Preparing the Beds.—It is impossible to prepare carpet beds on the same principle as is usually followed with other bedding plants; that is, to give much or little manure according to the wants of the plants that are to occupy the beds. The patterns are so complicated, that it is obviously impracticable thus to suit the soil to each; and therefore all must share alike in the best soil at command. Light deep loam, manured with vegetable or well-decayed farm-yard manure, does well for every kind, of course too well for some plants. But for all that it is best to err on the side of liberality rather than niggardliness in the matter of manure, and the soil should be broken very finely, and distributed evenly, else it is difficult to mark out the design with precision; and the plants being small, the slightest unevenness is observable and objectionable in patterns of such nicety.

The beds being raised above the turf-line is another point deserving of special attention. Any one who has observed the difference between those so raised, and those having their edgings level with the turf, cannot but have been favourably impressed with the superior effect of those with raised edgings. But then they must be real *live* edgings, not the hideous baked "mud walls" that one sometimes sees, with here and there an Echeveria stuck in, cockle-shell-like, as if courting contempt on the style generally. The manner of making up such edgings was detailed at page 105, and the best plant for furnishing them is *Herniaria glabra;* Sedums of various kinds do almost equally well; Echeverias and Sempervivums also do well, but they should always be in a setting of Sedum or other moss-like plant, that the whole of the soil may be covered.

Edgings being planted, and the surface being made smooth and even, and the designs decided on, and drawn out on paper, the marking out preparatory to planting comes next, and is a work of great nicety, requiring skill, and still more particularly perception as to proportion; because, though the designs may have been drawn out on paper, exact measurements on the ground as have been allowed in the scale of design may come awkwardly, and therefore there must be a certain latitude or licence to alter measurements, if the eye does not approve when drawn out on the ground. Hence, keenness of perception, and above all, for the operator to be in sympathy with his work, is necessary to success. Of course there must be no treading on the bed, either when marking, planting, or dressing; and to prevent this being necessary, what may be called a temporary platform should be constructed—a stout plank, long enough to go right across the bed, and elevated above it, supported at each end with large flower-pots, or better still, stout blocks of wood that have been cut for the purpose. Fine soil, and *exact* marking out, render the putting out of the plants a comparatively easy matter; and an unskilled workman may be trusted with that, if the places have been duly labelled, and the charge given not to hurry, but plant carefully, neither leaving a cavity next the roots, nor pressing them in too hardly, which practice either breaks the roots or makes the soil so pasty that when dry it cracks, and the growth of the plants is seriously checked.

Arrangements.—As remarked in a preceding paragraph, by this style of bedding winter brightness may, in part at any rate, be made a certainty; and in the arrangements here given, this point has been kept in view; all the hardy plants possible that look well in summer being used, that there may be a minimum of additional planting needed to make

them into good winter arrangements as soon as frost destroys the tender kinds. The arrangements are designed on the principle of avoiding undue excess of formality, by introducing what, for lack of a better term, we still call "dot" plants; thus rendering the word "carpet" as applied to the style inappropriate. This, however, is a matter of little consequence so long as the change is an improvement, which it undoubtedly is.

bedding, being quite hardy, very little trouble to keep in form, and almost pure white; this, placed as it is between Nos. 2 and 4, the one creamy-yellow and the other a glaucous blue, forms a combination of colour that no arrangement of flowering plants can excel.

This arrangement is the most formal that under any circumstances should ever be attempted. It would be a telling bed for the middle portion of two

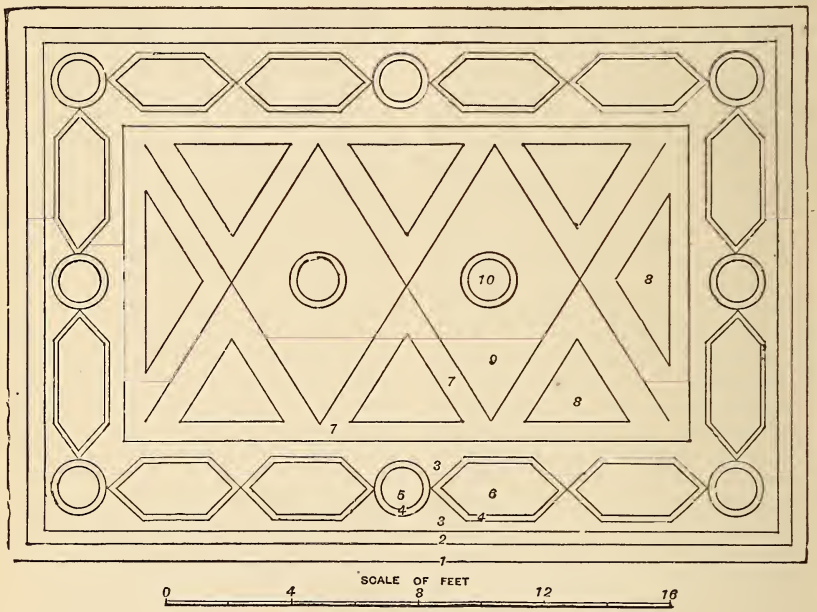


Fig. 5.—Carpet Bedding.

1, Raised edging of Sempervivum calcareum (commonly called S. californicum in gardens); 2, Sedum acre elegans variegata; 3, Antennaria tomentosa; 4, Kleinia repens, or Echeveria Peacockii; 5, Spergula prolifera aurea, centre Chamæpeuce Cabonæ; 6, Alternanthera spectabilis, centre Lady Plymouth Geranium; 7, Pyrethrum, Gold Feather; 8, dark Alternanthera, or Ajuga reptans purpurea; 9, Iresine Lindeni; 10, Chamæpeuce diacantha.

Plan Fig. 5 will, perhaps, best convey our meaning as to what are to be considered "dot" plants, by indicating the positions for them, these being Nos. 5, 6, and 10 on the plan; and to further break the flatness of the arrangement, the groundwork in No. 7 should be allowed to grow higher than that plant (Gold Feather Pyrethrum) usually is, and thus the height of the central portion will be considerably greater than that of the outer part. Though marked separately, the edging and enclosing band, Nos. 1 and 2, may really only be one line; or rather, the Sempervivum should be confined to the upright edging, and the Sedum planted in it as well as on the flat margin. No. 3, *Antennaria tomentosa*, is the perfection of a plant for carpet sets of beds of a less formal pattern, or as a *block bed* to divide a given set of beds in one aspect—say south—from a similar set looking east, this bed being placed in the south-east angle. Of course it may be of any size required, only the larger it is, just to that extent should be the turf surrounding it. The drawing of the design on the ground is solely a question of exact measurements. Being straight lines throughout, a line and measuring-rod with pegs and string for describing the small circles are all that is needed.

Plan Fig. 6 is one of the best carpet patterns, which, though it looks intricate, is not really so, there being no difficulty at all in filling out every

angle, which it is needless to say must be the case for the design to be effective. The planting arrangement here given is an exact copy of one actually done very recently; but a greater number of hardy plants would be used had we to do it again, and the Lobelia would be left out entirely, because of its failure before the end of the summer. This design is also an excellent one to fill wholly with hardy plants for the winter; and if we were called upon to thus are formed the six flat-iron-like points, and also the sides of the six triangular beds. The outer sides of the triangles are formed by running the string round the central stake, and so is the broad line of the six pointed beds. Again we repeat that exact measurement should be the first consideration.

Plan Fig. 7 may suit some tastes better, and it is certainly much easier to plant, and the greater

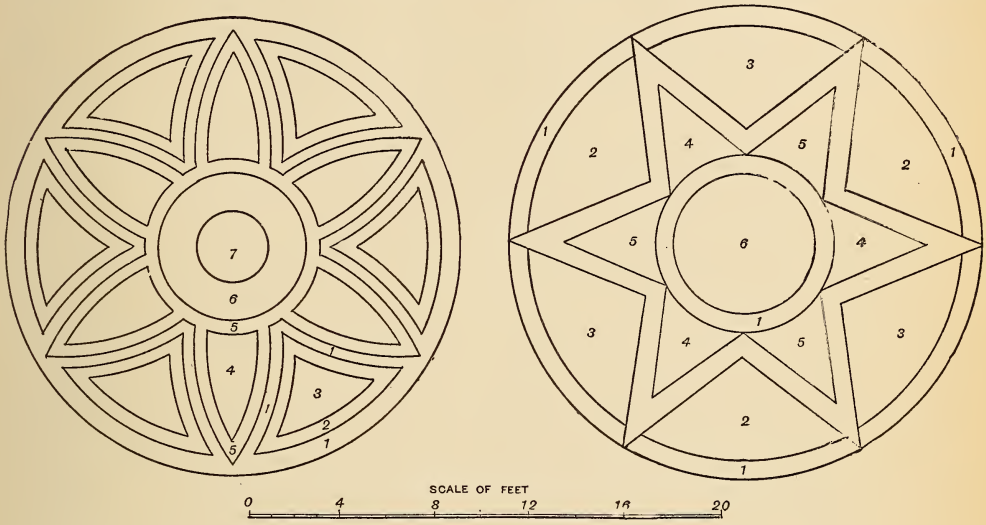


Fig. 6.—Carpet Bedding.

Raised edging of Herniaria glabra; 1, ground-work of Sedum glaucum; 2, Alternanthera amabilis latifolia; 3, Mesembryanthemum cordifolium variegatum, and a central plant of Echeveria metallica; 4, Lobelia pumila, dark blue; 5, Pyrethrum, Gold Feather; 6, Coleus or Iresine; 7, central plant, Dracæna australis, surrounded with Centaurea candidissima.

Fig. 7.—Carpet Bedding.

1, Sedum glaucum, and Echeveria secunda glauca; 2, Alternanthera magnifica, and dot plant of Sempervivum arboreum variegata; 3, Alternanthera paronychoides aurea, and dot plant of Echeveria metallica; 4, Sedum Lydium, green, and Pachyphytum bracteosum; 5, Herniaria glabra, green, and Kleinia repens; 6, ground-work of Mesembryanthemum cordifolium variegatum, filled out with various kinds of tree succulents.

so furnish it, the edging would be as now, also No. 1; then No. 2 might be the hardy British plant, *Ajuga reptans purpurea;* No. 3, the golden-tipped Stonecrop, *Sedum acre elegans*, with a small plant in the middle of it, of *Euonymus variegata aurea;* No. 4, *Erica herbacea purpurea;* No. 5, as now, Gold Feather Pyrethrum; No. 6, small plants of *Retinospora plumosa;* and No. 7, golden variegated Holly. We have practically tested this winter arrangement, and consider it a gem of the first water.

The marking out here is done by first getting the exact centre of the bed, into which a stout stake is put for the purpose of describing the outer circle by running a string round it: this line is then divided into six parts, and a good peg is put at each division, from which point another string measuring to the next point is run round the peg, and width for colour makes it more suitable than Fig. 6 for distant positions. If the star part be made a step higher than the circle, in the same way as advised for raised edgings, and the star-edge planted with *Sedum glaucum*, as well as the margin, the effect would be greatly enhanced. This plan is an excellent one for the small grass-plot of a villa, the planting in such a position to be as follows:—No. 1, *Sedum glaucum;* No. 2, edging of Gold Feather Pyrethrum, with blue Lobelia in centre; No. 3, also Gold Feather edging with Ageratum in centre; Nos. 4 and 5, the green *Herniaria glabra*, with small Echeverias planted in it; No. 6, a line of small plants—pegged—of golden variegated Euonymus, and the middle, any bright-coloured Geranium, which in winter time might be replaced with small shrubs or a good plant of *Yucca recurva*. The only

other plants that would need replacing for the winter are Lobelia, Ageratum, and the Echeverias; the latter, however, need not be replaced, as the green groundwork of Herniaria will be sufficiently bright, and in place of Lobelia and Ageratum, six dwarf evergreen shrubs of any kind will look well, and be in character with the season.

Arrangements and combinations of greater brilliancy than these might be given, but their season would be short-lived. The first cold night of autumn settles Alternanthera, Coleus, and similar tender kinds, and therefore it is better to confine the arrangements to such plants as last longest, though it may be at some loss of summer brilliancy.

It is necessary to observe in reference to the foregoing plans that, the patterns being of such a distinctive character, as they ever should be in this style of gardening, *perfection of keep* is of the utmost importance. The lines of colour should at all times be kept well defined by stopping, pegging, or pinching; and the standard plants be set off to the best advantage by always being maintained in an upright position by supports to the stems. This matter of "keep" is repeatedly quoted as derogatory to foliage or carpet bedding; but it is a charge which, if brought to the test, and compared with other modes of planting, cannot be sustained; it simply *looks* formidable, there being just as much labour to keep all other descriptions of planting (except the perfectly wild) in anything like the same degree of neatness, which in all kinds of gardening is a quality that should always be at the head of the list.

List of Plants.—The following are hardy kinds that may be used either in summer or winter:—

Antennaria tomentosa.
Ajuga reptans purpurea.
A. reptans variegata.
Artemisia judaica.
Cerastium tomentosum.
C. arvense.
Dactylis glomerata variegata.
D. glomerata elegantissima.
Euonymus radicans variegatus.
E. flavescens.
Herniaria glabra.
Leptinella scariosa.
Mentha Pulegium gibraltaricum.
Pyrethrum, Gold Feather.
Pyrethrum Tchihatchewii.
Stellaria graminea aurea.
Saxifraga hirta.
S. rosularis.
S. aizoides.
S. hypnoides.
S. densa.
Sedum Lydium.
S. corsicum.
S. glaucum.
S. acre elegans variegatum.
S. anglicum.
S. carneum variegatum.
Thymus citriodorus aureus.
Veronica incana.
V. repens.

List of Tender Plants for Summer Planting only.

Alternanthera magnifica.
A. amabilis.
A. paronychioides.
A. paronychioides aurea.
A. versicolor grandis.
Amaranthus melancholicus.
Coprosma Baueriana variegata.
Coleus Verschaffeltii.
Cotyledon pulverulenta.
Echeveria glauca.
E. secunda glauca.
E. Peacockii.
E. glauca metallica.
E. pumila.
Gnaphalium lanatum.

List of Tender Plants for Summer Planting only (*continued*).

Iresine Lindeni.
I. accuminata.
I. Herbstii.
Kleinia repens.
K. tomentosa.
Leucophyta Brownii.
Lobelias (pumila section).
Mesembryanthemum cordifolium variegatum.
Pachyphytum bracteosum.
P. roseum.
Rochea perfoliata.
R. falcata.
Tradescantia zebrina.

SUB-TROPICAL BEDDING.

As a rule, every one who is really fond of a garden has some special affection, or what is called "hobby," for some *branch* of gardening. Perhaps, if there is an exception to the general rule, "sub-tropical bedding" may be credited with that exception, and why? Simply by reason of the mistaken notion that the term sub-tropical *must* mean tender stove plants. This, it is true, is the most general interpretation; but, there being numbers of plants quite hardy, and others nearly so, which produce effects as striking and graceful as even the most tender, such a view is, to say the least, a very restricted one. Hindering—as such a view must—the carrying out of this style of ornamental gardening, either on a large or small scale, we shall endeavour here to show that sub-tropical bedding is formidable in name only; and that whilst the amateur, if so disposed, may have his one bed or single specimens of "sub-tropicals," the style is capable of extension to any desirable length at a very moderate cost of labour, and convenience for raising plants; certainly as cheaply as any other branch of summer bedding, and therefore worthy of adoption on the ground of variety alone, though not, be it understood, to the neglect of other departments. As much variation in style as possible, but each part well done, constitutes the great charm of a garden.

There is, of course, no valid reason why those so disposed, and who do not study cost or short duration of effectiveness, should not still continue their practice of putting out tender stove plants—grand Palms, Tree Ferns, and the like—except it be that such a practice fosters in some other minds a yearning after the unattainable, which would be considerably modified did they but know at what an enormous cost such fleeting beauty had been obtained. Writing more particularly for the general reader, and for the owners of small as well as large gardens, the tender exotic phase of sub-tropical bedding will not be treated on here, except with reference to fast-growing seedlings which can be raised in an ordinary pit or green-house, and which continue in good form until cut down by severe frost in October or November. Amongst such plants are Giant Hemp (*Cannabis gigantea*); all the Castor-oils (*Ricinus*); some few Solanums, Eucalyptus, Chilian Beet, and others to be named presently.

Character of Plants.—The first condition essential to selection is that the plants shall be distinctively *fine-foliaged* plants (not necessarily flowerless); another is that they shall be of easy culture; and a third, that they be of rapid growth. The last condition is of great importance, when the shortness of our most favourable summers is taken into account, and rapidity of effectiveness is necessary to get anything like satisfaction for the labour spent. Good culture will do something in this direction, such as taking pains with the raising of the plants, letting them have no check either from staying too long in the seed-pans, or getting root-bound before repotting, or exposing them to the atmosphere before they have been duly prepared by partial and gradual hardening off; and, lastly, by sparing no pains in the preparation of the beds. Warmth of soil is insured in the coldest districts by well draining, trenching deeply, and throwing up the soil above the ground-level of the turf, that the sun may have full power, not only on the flat portion of the bed, but through the upraised earth. As to manure, plants of this character will take any quantity in reason, and need it quite as much to develop their full beauty as for rapidity of growth.

Site for Sub-tropical Beds.—The plants, for the most part, being tall, and some of them tender, naturally suggest shelter. A deep dell, and an open slope sheltered from north-east winds, are both excellent sites, and if close to a lake or stream the value of such sites will be increased, as some of the plants only look their best in association with water, notably so the Arundos, Bamboos, and Phormiums. Another desirable condition in the choice of site is, that the surroundings be sufficiently *massive;* or in other words, that there be a good background either of shrubs, banks of turf, ivy, or other greenery; such solid surroundings are quite indispensable to bring out the full beauty of such finely-cut foliage as that of the Sumachs, or the flowery panicles of *Bocconia cordata*, or of *Humea elegans*.

These of course are named as *best* sites, but the owner of a small villa garden, if he only has shelter, may if so inclined have a first-rate sub-tropical bed. Say for instance he has a large circular bed, and wishes it planted effectively after the sub-tropical fashion; here is the arrangement. In the middle plant a large clump of the hardy Bamboo (*Arundinaria japonica*, generally grown under name of *Bambusa Metake*); or else of New Zealand Flax (*Phormium tenax*); then three plants, equal in size, of seedling *Albizzia lophantha*, generally known as *Acacia lophantha;* and next six plants of *Grevillea robusta;* the outer row of all being twelve plants of variegated Abutilon; the edging to be the hardy variegated Plantain Lily (*Funkia ovata variegata*). All these plants can be bought at the price usually paid for common Geraniums, and are therefore within the reach of all. The bed can be filled out either with flowering or foliage plants; considering the position, we should advise the former, the kinds to be either Geraniums or Fuchsias, or both in mixture; should foliage plants be preferred, variegated Thyme, Gold Feather Pyrethrum, or any of the mossy selection of Sedums, would be appropriate.

Arrangement and Form of Beds.—Though there are numbers of plants that do well singly in isolated positions on the turf, and some should thus be planted, care and good judgment are needed in their dispersion, otherwise the garden will present a too "dotty" appearance. Good breadths of turf between each bed are of infinitely greater importance than even the arrangement of plants in the beds, hence the necessity for being specially particular as to the planting of single specimens on the turf. An angular nook, or a piece of turf of that form, or as a divisional line to a set of beds—these are the only rightful places for single specimen plants in the sub-tropical garden; whilst as to shape or form of beds, none are so telling as ovals and rounds, and the size of each should be determined by the size of the garden, not forgetting that wide spaces of turf between each are of the greatest importance. Long borders, not formal in design, but the front part running in irregular semi-circular shape, are also suitable forms for sides of banks which are well backed up with shrubs. The free and stately habit of growth of all kinds of sub-tropicals, is sufficient of itself to show how inappropriate fantastically formed beds would be in a sub-tropical garden, and therefore their adoption should never be thought of.

Arrangement of Plants.—If due regard be had to avoidance of the "dotting" mentioned in the preceding paragraph, and the beds are of a good size with wide sweeps of lawn between them, the general arrangement of the whole will be of the easiest description: for even if the variety of plants at command be limited, it will then be possible to so intermix and place them apart, that want of variety will only be observable after strict scrutiny. What we shall call the *mixed* plan of arrangement is that we practise, and recommend; for though it is most usual to have a bed of a kind, there is about such an arrangement, however elegant the plant may be, a lack of variety and a "lumpy" appearance most objectionable from any, but particularly from a true garden artist's point of view.

Strictly adhering to this mixed plan, the following is an arrangement for the long border above

mentioned:—Standard or "dot" plants of Sumach, variegated Maples, and *Albizzia lophantha*, with intermediate plants of *Arundinaria japonica*, then filled in with dark-leaved Cannas; the outer margin, or front of bed, to be *Grevillea robusta* and *Yucca recurva*, on a ground-work of *Salvia argentea;* edging with *Solanum pyracanthum*. An oval arrangement is as follows: three large plants, equidistant through centre, of variegated Abutilon; then five plants of arrangement of dwarfer plants for a circular bed consists of a central plant of *Dracæna australis;* next three plants of variegated Yucca; next six of *Solanum pyracanthum;* the outer line being six other Solanums, alternated by six white Thistles (*Chamæpeuce diacantha*); the edging to be a complete line of the Fish-bone Thistle (*Chamæpeuce Casabonæ*); and the undergrowth common Stone-crop (*Sedum acre*).

These arrangements will sufficiently indicate what

Sub-tropical Beds at Heckfield Place, Winchfield.

Ricinus Gibsonii, also through centre; then a line each side of *Fatsia japonica*, commonly known as *Aralia Sieboldii;* the outer margin *Centaurea candidissima*, filled in on each side of bed with *Solanum robustum*, in the centre of Solanum being one good plant of *Ferula communis*. A circular arrangement is a central plant of *Eucalyptus globulus;* next three plants of variegated Phormium, with intermediate plants of *Melianthus major;* then a circle of Cannas; next a circle of *Solanum marginatum:* and the bed filled out with white and grey Thistles (*Chamæpeuce diacantha* and *Chamæpeuce Casabonæ*). Another most elegant

we mean by *mixed planting*, and will suggest other arrangements. Moreover, it is not imperative that a sub-tropical garden should be wholly composed of foliage. This once was our view, but practice has shown that it was a mistaken one—at least, so far as our taste is concerned. We now use Sunflowers, intermixed with the Giant Hemp (*Cannabis gigantea*), for greenery, the graceful and finely-cut foliage of which makes a most perfect setting for the now fashionable flowers. As a setting for single Dahlias we use *Ferula communis*, the Fern-like foliage contrasting most beautifully with the broad foliage of

the Dahlias, whilst the flowers of the latter, resting on the Ferula, present somewhat the appearance they do when cut and arranged in vases with Fern-fronds. A bed of tall and standard Fuchsias, intermixed with dwarf plants of *Grevillea robusta*, or with seedling *Acacia lophantha*, is also another very telling arrangement to place between surrounding beds of foliage plants. The flowery panicles of *Humea elegans* look appropriate in almost any position, or in association with all varieties of sub-tropicals; and the plant is one of the best, if not the very best, of all the kinds for isolation on the turf.

The hardy herbaceous *Bocconia cordata*, which in good soil attains a height of eight feet, and flowers profusely, also does grandly in association with the more massive sub-tropicals, such as Cannas and Wigandias, but should always be used as a central plant. It also makes a fine permanent lawn plant; a large group of it, either on the open lawn amongst the beds, or in a nook of the lawn, having a dark background of shrubs, has a most charming effect.

List of Plants.—Further particulars as to arrangement are unnecessary, but the following list of plants will show how greatly at the will of the operator they may be varied:—

Hardy Kinds.

Acanthus latifolius.
A. spinosissimus.
Aralia canescens.
Arundinaria falcata.
A. japonica.
Arundo conspicua.
A. donax.
Ailantus gladulosa.
Bambusa Fortunii variegata
Bocconia cordata.
Crambe cordifolia.
C. juncea.
Chamærops humilis.
C. Fortunii.
Fatsia japonica.
Funkia Sieboldii.
Funkia Sieboldii variegata.
F. ovata aurea.
Ferula gigantea.
F. communis.
Gynerium argenteum.
Melianthus major.
Phormium tenax.
P. tenax variegata.
P. sanguinea.
Rhus Cotinus.
R. glabra laciniata.
Sambucus nigra aurea.
Tamarix germanica.
Tussilago Farfara variegata.
Yucca filamentosa.
Y. recurva.

Kinds Easily Raised from Seeds.

Albizzia lophantha.
Amaranthus melancholicus ruber.
A. caudatus.
Beta chilensis.
Cannas.
Cannabis gigantea.
Chamæpeuce Casabonæ.
C. diacantha.
Eucalyptus globulus.
Ferdinandia eminens.
Grevillea robusta.
Humea elegans.
Nicotiana macrophylla gigantea.
N. wigandioides variegata.
Perilla nankinensis.
Ricinus (all the varieties).
Salvia argentea.
Solanum (all the varieties).
Wigandia caracasana.
W. Vigieri.
Zea japonica variegata.

Kinds Suitable for Undergrowths to Larger Plants.

Abutilon vexillarium variegatum.
Centaurea candidissima.
Cineraria maritima.
Cerastium arvense.
C. tomentosum.
Dactylis glomerata variegata.
Euonymus radicans variegata.
Pyrethrum, Golden Feather.
Gnaphalium lanatum.
Herniaria glabra.
And all the mossy sections of Saxifragas and Sedums.

This is a long list, and necessarily so, as it is intended to embrace plants in sufficient variety for the largest garden. Those having but a small space to furnish, and restricted in their conveniences for raising the plants, should confine themselves to the hardy kinds, and such of the annual seedling kinds as can be raised in a frame or small green-house. Hemp, Castor-oils, Chilian Beet, variegated Maize, and Perilla are amongst those most readily raised. Particulars as to raising and propagating these and other bedding plants have already been given.

General Culture.—The principal requirement under this head consists in keeping the plants in a growing state by copious supplies of water and mulchings of manure, fine soil, or cocoa-fibre (this last is the neatest), till the plants have filled out the bed, when, as it were, they form their own mulchings. The ground-work plants and edgings should be gone over about once each week, for the purpose of pinching out the points of straggling shoots and pegging them down, and the tall plants should be tied to stakes, care being needed that the ties are not made so tightly that the plants get crippled. Many of the plants swell out their stems so rapidly that tying demands particular attention. Generally it is best to let all tall plants grow after their own natural habit, but sometimes a strong shoot or lead will grow out of all proportion with the others; in such a case the points should be pinched out, with a view of obtaining greater uniformity of growth; for though a formal appearance is undesirable, there should be no perceptible want of balance of growth in the same bed.

It is not generally known that all the rapid-growing annual sub-tropicals are amenable to stopping or pinching, particularly of the side growths, so that, if need be, this operation may be performed on them. One of the most beautiful arrangements we have ever seen was so treated; the plants were *Ricinus Gibsonii*, which were so repeatedly stopped back that they developed quite a bushy, not to say flat habit of growth. The rich bronze-brown of this *Ricinus* was set off to perfection by having for a cushion the creamy-yellow *Abutilon vexillarium variegata*.

SUBURBAN GARDENING.

By James Hudson.

THE SUPPLY AND GENERAL MANAGEMENT OF SMALL GARDENS.

Propagation.—The hints given with respect to the propagation of the Aucuba may be followed in the case of other plants and shrubs that do not readily

strike root when taken as cuttings. It is a pleasure to be able to raise some at least of the many plants that are cultivated in our gardens. Their growth and progress are oftentimes more closely watched over when such is the case. The Virginian Creeper, the Ivies, the Wistaria and *Jasminum nudiflorum* among climbers, may all be increased by the method just detailed. The process would be too slow in the case of the Rhododendrons; these will be more satisfactory if purchased. The common Berberis, or Mahonia (*B. aquifolia*), is very easily increased by the small suckers that are put forth from time to time around the parent stem. These make very pretty and most useful plants for small borders, with a little nursing. The Yuccas (Adam's Needle) can also be increased from suckers, which, when of good size, can be severed from the parent plant. The *Euonymus latifolius* is readily propagated from cuttings of the half-ripened wood, which should have a spot chosen for insertion where partially shaded. Nearly all the shoots of shrubs, in fact, that are attempted to be struck from cuttings should be inserted when the young growth is fairly made, with both leaves and shoots becoming solidified. This applies also to Roses of good constitution, which will thrive as well, or better, on their own roots than when either budded or grafted. If a sheltered nook could be spared, only a few square yards even, it would afford much enjoyment to endeavour by propagation to increase the stock of garden favourites that are most preferred, or are found to be the best suited to the locality. Such a piece of ground should have a little fresh soil added to it occasionally, with some road grit or sand, to encourage the young and tender rootlets to make better progress.

Several garden favourites can be conveniently increased by seed, with the protection of a cold frame; even a small one would during the season be capable of nourishing a goodly number of plants. Among these may be named the Carnations, Picotees, and Pinks; a packet of seed of either, purchased from a reliable source, would furnish a considerable number of plants. Personally we much prefer this method of raising our stock, in the first instance, of these beautiful flowers. After proving them at flowering time, the worst can be discarded, whilst the best and most promising ones should be increased by layers, which is an easy operation to perform, merely having to sever the best shoots about half through the growth and in an upward direction, leaving a tongue-like point, around which the future roots will be emitted when placed in contact with some good loamy soil, into which they will soon push forth their roots. Whilst this is in progress, attention will be requisite, in the way of watering, to encourage more rapid root-action. In six or seven weeks these will be mainly depending on their own roots, and may then be cut off from the parent plant, and removed to their future quarters; or potted up into small pots, to be kept through the winter in the cold frame, and planted out in the following February. This is a better plan to follow than relying on annual purchases from those who hawk these plants about in the spring. These may look promising, being robust and healthy, but frequently lead to disappointment in the inferior quality of the flowers. Other border plants that do not readily push forth young roots, as they spread along the ground, can be treated in a like manner.

Those plants which are disposed to take root as they spread, and thus form many plants, as it were, may be easily increased by division. It is advisable, in fact, to take up the entire clump of any given plant at times, and choose some of the most promising pieces for re-planting, selecting at the same time a fresh spot for them, or to renew the old soil if planted in the same place again. Violets, for instance, should be re-planted every spring to insure a vigorous stock of blooming plants, choosing the strongest and best pieces. About the end of March is a good time to do this work, in order to secure as long a season for the growth as possible. The improved varieties of Violets that are now grown, as has already been stated, will in favourable positions and in good seasons give a good supply of flower during the autumn months. We find in the neighbourhood of London that the fogs of the autumn are most injurious to their foliage, perishing it in fact, in conjunction with frost. A successful cultivator has informed me that he goes over his stock and cuts off the leaves when they are over-abundant before the flowering time. On a piece thus treated he obtained a good quantity of flowers, whilst on another that was left with the foliage intact, hardly any flower was obtained, the foliage in the latter case rotting down, and thus perishing the early flowers.

The near allies of the Violets, belonging in fact to the same genus, are the Pansies or Heartsease, which are beautiful flowers for the early spring months. These can be purchased cheaply enough early in the season, when the first flowers are beginning to unfold themselves; one cannot then be far wrong in purchasing such in the cheapest market. Having got a stock, the same can be increased by division as may be necessary; they can also be propagated from cuttings, but this is a more uncertain process to those who have not had previous experience. When the flowering season is over, the straggling growths should be cut off; this will induce the plant to break afresh from the crown. After these young growths

are well started, the plant can be taken up and divided. They can also be very easily raised from seed, which, if sown in May or June, will give nice plants by the autumn for flowering the next spring. This is a most interesting method of raising a stock, by reason of the great *variety* of colours and markings that will be obtained from a packet of mixed seed. When signs are seen of the seedlings coming up, damage from slugs must be prevented, or the young and tender growths will soon disappear. One section of this class of plants is generally called by the generic name (Viola) among cultivators; those thus designated will flower the greater part of the season, with proper attention in respect to watering, and the removal of seed-pods. This latter operation is an essential point not to be overlooked by those who value the greatest possible extension of the flowering season. All plants that seed freely are considerably overtaxed when developing their seed-pods and producing flowers at the same time. The Tropæolums, or Nasturtiums, are an instance of this; so are the Sweet Peas. These all seed so freely that if their pods are allowed to remain it is not possible for them to produce either the quantity or quality desired in their flowers.

The double perennial Daisies, already described, are another favourite class of plants for small gardens; and they are excellent for edgings to the borders and beds, being both neat and compact. These are to be seen offered for sale in quantities during the early spring, as in the case of the Pansies. We would not advise the purchasing of them at that period of the year unless urgently needed, for the following reasons. In the first place, when exposed for sale at that time of the year, they are opening their first flowers; those that should succeed these for several weeks will not be nearly so fine as they should be, by reason of the removal of the plants, and the consequent loss of roots and check to the vital functions of the plants. If not looked closely after for watering after being newly planted, they will soon perish; the leaves will turn yellow, and the plants get less day by day. This will cause their owners to give up in despair, perhaps, but such need not be the case; for by transferring the planting operations to the autumn, when the bedding plants and other tender subjects are past their best, and only fit for removal, then the Daisies, and many other kindred plants on which reliance can be placed for quality, may be planted in their place. All plants thus treated in the autumn have every opportunity of becoming well established ere the flowering season comes round. The floral beauties of many plants will thus be greatly enhanced, giving far more satisfaction to the purchasers.

We consider it is a mistake on the part of the growers of such plants for town sale not to push them into prominent notice in the autumn instead of the spring. Of course there is this difficulty, the plants are less attractive, and consequently not so likely to draw customers, when out of bloom. On the other hand, however, the purchasers would have the pleasure of seeing their gardens filled to a certain extent in the dullest season of the year, which would be far better than having the beds and borders looking bare and barren, especially where an undue proportion of summer bedding plants have been employed, and which have to be removed in the autumn.

In another way this latter defect may also be remedied, and that, too, by a very economical process. By reserving two or three square yards where best to be spared, some seed of *Myosotis* (Forget-me-nots), which are always favourites in the spring months, might be sown during June. These seedling plants, when of sufficient size to handle, should be taken up carefully and pricked off a few inches apart wherever room can be found, as long as they are not too much shaded. These would make good plants for removal when the bedding plants of the summer were taken up, and thus more room being made for them. *Silene pendula compacta*, pink and white varieties, would be excellent things to use in association with the blue Forget-me-nots, being raised from seed, and treated in the same way as just recommended.

Primroses and Polyanthus can be raised in the open border, but success is more certain with the protection of a hand-glass or cold frame. Seed should be sown of this garden favourite in March or April, to flower in the following spring. Wallflowers, again, are another easily-managed class of plants. If the seed is sown in May or June, and then treated like the Forget-me-nots, they will come into flower about the same time. A list of some of the most popular annuals to flower the same season as sown will be given in another article.

Sowing Seeds.—In the sowing of seeds, some extra care is advisable in preparing the soil. The operation should not be done when the ground is very wet, neither when it is at the other extreme. When it (the soil) works well and crumbles to pieces in the hand will be the best time. The smaller the seed, the finer should be the soil that covers them. Be cautious with watering till the seed is germinated: what is given previous to that time must be applied with a fine rose on a water-pot; but much will not be required till the young plants are fairly advanced in growth. The state of the weather must be taken into consideration. If seed is sown in hot weather, it is a good plan to cover the ground during the heat of the day till it shows

signs of coming up. If any seedling plants are intended to remain where sown, see that they are thinned out should the seed have come up thickly. This should be done as soon as the strongest plants are discernible. If this is overlooked (and it very frequently is), the young plants will draw one another up in a weakly manner, shortening the flowering season by many weeks.

Buying Plants.—In the event of the requisite quantity of young plants having to be bought, some little advice in the selection is necessary to purchasers, and that is to closely examine the plants ere they buy them when offered for sale by other than the growers. The plants may have been out of the ground for some few days, and thus have lost many of their fine fibrous roots by exposure, and have probably suffered from drought; the latter, combined with a keen cutting easterly wind, will very soon make their ill effects apparent, and which are not always easily remedied after being re-planted. These little minor details should be looked into and practised to insure the greatest possible amount of success in the future. After a few failures (from unexplained causes to those who are not well acquainted with the requirements of plants), the lover of a few garden flowers becomes discouraged, and is inclined to give up in despair. The why and wherefore of failures should, therefore, be investigated as far as is possible, and the few hints just given may explain the origin of many such cases

Constant attention to the *wants* of plants is essential; but when a study is made of this, one piece of knowledge gained by experience will lead on to further enlightenment Some, we fear—and those not a few—having planted their flowers, think that no further attention is needed but to wait for their floral beauties to develop. Now, this is a great mistake. It is not in accord with the dictates of nature to expect this trusting to chance to succeed. Now and again there may be a case in which, by mere good fortune, one has succeeded, but it is only one record of success against many failures. When plants are obtained and inserted into the soil in the position they are to occupy, see first that the latter is in good condition, as far as it can so be made, to meet one essential point to future success—viz., the encouragement of a fresh root-action as quickly as possible. Do not plant after a heavy rain if the soil is at all heavy and tenacious. In sandy soils this is not so important, but even then planting should be deferred if the ground be excessively wet, as it cannot be worked around the roots of the plants at such times in a proper manner, for obvious reasons.

Watering.—When planting is finished a sufficient quantity of water should be given to settle the soil around the newly-inserted plant. After-waterings must be regulated according to the time of year and the state of the weather. During the early spring—in fact, up to about the time of planting "bedding" plants—the greater part of this work is best performed in the morning, thus allowing the plants and soil to absorb the moisture before the chilly and perhaps frosty air of the evening and early morning sets in. From the middle of May onwards through the summer the watering may be more advantageously performed during the latter part of the afternoon and evening. After a warm sunny day it will greatly refresh the plants to have a gentle bedewing either from a syringe or through the fine rose attached to a watering-pot. Thorough watering is not essential every evening; a goodly quantity should be given, however, when it is done, so that the soil is well penetrated therewith. Should the latter have become somewhat hardened on the surface, and thus cause the water to run off instead of percolating downwards to the roots, a digging-fork should be taken in hand and used cautiously to break up the surface soil, but not deeply, for fear of injury. This operation will also act beneficially by opening up the soil to the action of the air, and in other ways. Water should then be applied gently, not flooded on to the soil in such a way as to cause it to run to waste. When a fork is not taken in hand to break up the surface of the ground, a small hoe—termed a "Dutch hoe"—will be the next best thing to use.

This is also an excellent tool for almost daily use—in fact, it should be used as frequently as the broom is for sweeping purposes. Careful use of the hoe will aid materially in keeping down the weeds that would otherwise grow up but too quickly if left undisturbed. It is far easier to destroy the weeds in the earliest stages of their growth than to leave them until they become an eyesore by their prominence, impoverishing the soil, and giving more trouble in their extermination and removal. Hand-pulling of weeds will, of course, have to be resorted to when the plants have become grown together in such a way as to endanger their safety in the use of that implement. This operation should be performed as soon as the weeds can be handled. It is an excellent plan to surface or top-dress the flower-beds and borders with cocoa-fibre refuse. This is an extremely valuable medium, both for conserving the moisture in the soil and also for keeping the roots cooler and less susceptible to sudden changes from atmospheric causes. In two ways, also, this "refuse" will be a saving of labour: it will be the means of keeping in check the growth of weeds, as

well as dispensing with the otherwise more constant attention in the use of the water-pot. It has also a clean and neat appearance to the eye, being, in fact, a finish, we think, to small arrangements in every way. It will also act as a manurial agent when applied to heavy, retentive, or adhesive soil.

The Soil.—Flower-beds and borders will in the course of time require re-invigorating, either by the application of some fresh soil or the addition of manure. The former plan will permanently raise the beds, &c.; this, to a certain extent, would in many cases be a benefit, but should not be carried too far. By adding manure no perceptible variation in this way will be seen for several years. In either case, when some soil *can* be dispensed with, manure would be an assistance to the permanent trees and shrubs, aiding them in rooting nearer the surface rather than compelling them to seek their nutrition by penetrating the subsoil when overlooked. Artificial manures of good lasting properties are also to be recommended, but must be used with caution. If applied too liberally, they will be productive of leaf-growth with the certainty of fewer flowers. The printed directions of reliable firms should not be exceeded, and these are generally to be had when purchasing these manures. Large quantities should not be purchased at one time, for by keeping some kinds degenerate in their fertilising powers. Such manures must not be exposed to the action of the air after they are opened for use, as this will greatly deteriorate them.

On heavy clay, or any stiff-working soil, the addition of some road scrapings will be a great help to the better working of the ground, when the same can be had in a dry or medium dry condition. Well-decomposed manure is better for light, sandy, or porous soils; to such also a few additions may be made of good loam when about to be got in readiness to receive a fresh instalment of plants. Do not let the manure lie about, but see that it is dug in at once, to preserve its good qualities for absorption by and the enrichment of the soil.

Opportunity should be taken of giving the ground an extra deep digging when cleared of plants that have been on it for any length of time. This is not an easy matter at all times in small gardens, but will be found a benefit whenever the opportunity occurs. The best time to do this would be in the annual autumn clear up—not the following spring, as many have done it to the loss of its full benefit.

The Lawn.—The lawn will also at times need attention to impart fresh vigour to the growth of the grass. The sowing of a small quantity of grass-seed, mixed with a good amount of soil that has been freed from lumps and hard substances, is a great aid on any bare or thin patches. This would soon germinate and produce a fresh green sward in the growing weather of April and May. This by seedsmen would be termed a "renovating" mixture. The laying down of lawns in a permanent manner with grass-seed instead of turf was advised in the previous article, and if this advice be followed the lawn will eventually look far nicer; being a *grass* lawn, and not a mixture of grass and many weeds, perhaps more of the latter after the lapse of a few years than of the former. This will give additional labour to the lover of his garden plot, which to a very great extent might have been prevented. It is well known that many useless plants, at least from a garden point of view, that we designate as weeds, are to be found among the herbage of grass-land from which the turf is taken for garden lawns. All such are easily avoided when grass-seed is sown instead, besides being very considerably cheaper in the first instance.

The lawn-mowers for small gardens should be proportionately small. Those with cutting capabilities of ten inches in width would be ample in every case where one sees to his own garden, and even six inches will do good work. It is far easier worked around the edges of beds and borders than those of larger size, and will be found to work quite heavily enough by those who are not accustomed to their use. Keep them well oiled and cleaned, with protection from wet if possible when not in use. Do not work them when the lawn is very wet, or a smeary surface will be left in places. The best time to use lawn-mowers is when the lawn is quite dry; the work will then be done in a far cleaner manner, and much more easily. We prefer those patterns that are arranged with a collecting box, which is generally allowed for by the majority of the manufacturers. Some writers have, however, advised the use of the machine without the box, leaving the grass to dry up on the lawn, which must at the best look very untidy; and in a small garden such defects are always readily discernible, even more than in those of larger dimensions. The box can be taken off, and the machine used without it, when the grass cannot otherwise be conveniently cut around the stems of trees, or in confined spaces.

THE VINE AND ITS FRUIT.

By William Coleman.

PROPAGATION OF THE VINE.

Of all the fruit-bearing trees under artificial treatment, the propagation of the vine is perhaps the most simple and varied. It can be propagated to an endless extent by means of seeds, cuttings, layers,

and buds, or single eyes. The first method is not often brought into requisition, and it is to be regretted that it has been almost entirely given over to the hybridist, who works by cross-fertilisation for raising new kinds, when freaks of an extraordinary nature frequently follow. If seeds of many of our old kinds that have not been cross-fertilised are sown, they invariably reproduce themselves; when, like the offspring of any other family, they differ in strength and robustness of constitution, but they are not hybrids. Bowood Muscat and Venn's Seedling are said to be seedlings from the old Muscat of Alexandria and the Black Muscat, and they differ from their parents to an extent that leads many to consider them distinct varieties: the first, in being earlier and requiring less heat, and the second in having a better constitution, in setting better, and having a thicker skin and shorter foot-stalks; the grapes also keep much longer after they are ripe.

Assuming that seeds have been saved, they should be sown in pots or pans, in February, plunged in bottom heat in a propagating-pit, and the young seedlings should be potted off singly when they are large enough to handle. If re-plunged at once into bottom heat and treated as vine-eyes, they will make rapid growth and soon be large enough for inarching on established vines for trial. If stocks are not available, they can be grown on, and fruited in pots. Mrs. Pince and Madresfield Court Muscats, Alnwick Seedling, Duke of Buccleuch, and a host of others, are English hybrids.

Cuttings.—As every bit of well-ripened wood, containing one or more eyes, will throw out an abundance of roots when placed under the influence of warmth and moisture, no difficulty is experienced in getting cuttings to grow very freely. In vine-growing countries, where the vines are propagated by tens of thousands, the cuttings are made from pieces of wood some four to six eyes in length. Hardy kinds are sometimes propagated in this way in England, and they do very well for walls; but plants so raised do not make the best vines for hothouses, as the cuttings harden and form an obstruction to the descending sap when the vines get into free growth. Where convenience for striking them in heat does not offer, short-jointed pieces, prepared like Currant cuttings—*i.e.*, with all the lower buds removed—may be put in against a warm wall or fence at pruning time. The following season they should be encouraged to make two shoots, which will get properly ripened by the autumn; but as this rarely happens in this country, the method is of little use to the cultivators for whose guidance these papers are written.

Fig. 5.—Cutting.

Layering is the primitive method employed for increasing the stock of established varieties, either out of doors or in vineries. The layers may be pegged down into pots, or directly into the borders, where, without notching or twisting, the moist soil soon induces the formation of an abundance of roots. The young vines, when ripe and dormant, can be severed and taken away for planting, or they may remain attached without detriment to the parent vine.

By adopting this method it is no unusual practice, where vines are planted inside, to make one particular variety fill a whole house, by constant layering and cutting away other kinds as the space is required for extension.

In this way the late house at Eastnor, which originally contained one vine of Lady Downes, was filled with that best of all late-keeping grapes.

In this way also Mr. Wildsmith, the intelligent gardener at Heckfield Place, after carrying his Lady Downes vines over the two sides of a span-roofed house, layered all the leaders into the border opposite to that from which they started, and, strange as it may appear, severed them at the base. By a single stroke of the knife the vines were made to stand on their heads, without suffering any apparent diminution in the quantity or quality of their produce.

Eyes.—The fact that an enormous number of young vines are now raised annually from single eyes, stamps the system as being the best yet introduced by the British grape-grower. In all cases, the wood from which eyes are taken should be firm and well ripened, as success greatly depends upon having a perfectly matured bud to commence with. There are two ways of making the eyes ready for potting; some cut them half an inch above and below the bud (Fig. 6), while others slice a piece off the lower side to induce the rapid formation of roots; but this is a matter of little consequence, provided a steady bottom heat of about 80° is constantly maintained in a propagating-pit, which can have full exposure to light. The eyes should be planted early in January in small pots, rather firmly filled with rich loam and sharp sand, dry enough to bear pressure without becoming adhesive. The pots and buds being ready, the usual method is to scoop out a little of the soil, replace it with sand, and press the bud firmly down until it is level with the surface, when a light sprinkling will be necessary to consolidate the

sand at the base of the bud. If a close, temperate frame is at command, it is a safe practice to place all choice kinds in it for a fortnight before they are taken into strong bottom heat, as an excess of this element forces the bud in advance of the roots.

When the young plants have exhausted the sap contained in the eye, in the formation of the first one or two leaves, very steady top and bottom heat will be needed to aid in the formation of the first set of roots; and when they touch the sides of the pots, as will be indicated by the young shoots making a fresh push into growth, a shift into five-inch pots will be necessary. A bottom heat of 85° will not, now, be too much; and more light and air, while securing a quick growth, will also tend to its being short-jointed and stocky. As days increase in length and solar heat becomes more powerful, the growth of the young canes, as well as the roots, will be very

Fig. 6.—Dormant Eye.

Fig. 7.—Dormant Eye.

rapid; more head-room will be required, and unless the vines are intended for summer planting, they will also be benefited by the final shift into eight-inch pots, which is quite large enough for store vines.

In order to secure firm, short-jointed canes, either for planting or growing into fruiting vines, great care should be observed in the preparation of the pots and the soil for the final shift. The compost should consist of sound, rather light loam, with a liberal admixture of bone-dust, burnt earth, or charcoal. Pot firmly, and re-plunge for a short period to give the roots a fresh start. When they have recovered from the check, gradually raise the pots out of the bottom heat, but allow them to stand on the surface of the bed until they require more room. Keep them regularly supplied with warm, diluted liquid manure, and syringe overhead when the pit is closed in the afternoon. As soon as there is danger of the foliage obstructing the light, remove all the strongest to a light house, where they can have the benefit of a temperature ranging from 65° at night to 80° by day. Pinch all laterals at the first joint, and finally stop the points when they have made canes six feet in length. If any of the top buds break, let them grow a little and stop again. Keep them fully exposed to every ray of sunshine, give air early on bright mornings, and close with moisture in moderation, as too much produces warts on the under sides of the leaves, which in time check the progress of the vines. When the young canes begin to show signs of changing to a bright cinnamon colour, gradually withdraw atmospheric moisture, but on no account neglect the roots. Remove the laterals from the base up to within a foot of the top bud, carefully preserving the main leaves, as they will have to feed the buds, now plumping up in the rapidly-thickening canes. Increase the circulation of warm air as the ripening process goes on, lower the night temperature, and discontinue syringing altogether, if the foliage can be kept free from spider without it. When the leaves fall, place the vines in a cold house or against a wall, where they can be protected from heavy rain and severe frost, but never allow the roots to become dry. If fruiting vines in pots are wanted, ten or eleven-inch pots should be used instead of eight-inch. In all other respects, the treatment of the two sets will be identical.

Fig. 8.—Eye starting into Growth.

Eyes in Turf.—We are indebted to Mr. W. Thomson, the intelligent proprietor of the Galashiels Graperies, for this excellent way of propagating vines specially intended for spring planting. The eyes are prepared in the usual manner, but instead of placing them in pots, small squares of thin turf are laid close together, grass side downwards, on the top of a hot-bed. One eye is inserted in the centre of each square, which it soon fills with roots; and young canes in the rudest health, with roots radiating in every direction, become fit for permanent planting or potting by the end of May.

Grafting.—This is an operation in which many are not so successful as they could wish, and yet it is extremely simple, provided that it is done at the proper time. The most successful grafters of the vine are those who can have patience to wait until the sap is in free motion, and all the cells are full, as, owing to the porous nature of the wood, every cut

made, when the sap is comparatively motionless, speedily cicatrises, and no after-flush can force it into the scion.

Whip Grafting is the method usually resorted to, and the mode of procedure is as follows:—Head down the stocks early in the autumn to prevent bleeding, then having selected the scions from well-ripened vines, insert them in moist soil in flower-pots, and place them out of doors behind a north wall until after the house containing the stocks is closed for starting. When the buds on the stocks begin to break freely, introduce the pots containing the grafts into a warm house in order to get them also into a state of excitement. When the terminal bud on the headed stock has made a growth containing three or four leaves, prepare the graft, and fit it on immediately opposite the shoot, which must be carefully protected from injury during and after the operation, as the loss of this shoot would end in failure. Bind well with good matting, clay up in the usual manner, and add a little moss to prevent it from cracking, as well as to retain moisture throughout the day after syringing. When all is complete, pinch the point out of the young shoot on the stock to throw a flush of sap into the scion, and gradually cut away the remainder when the graft has started into vigorous growth. To those who have never practised this kind of grafting, the annexed sketch will convey all that is needed for their guidance. The late Mr. Cramb, gardener to Earl Ducie at Tortworth Court, invariably grafted all his vines upon the Hambro' in the following manner:—Having decided upon making a new border, say for a house of mixed grapes, young Hambro's were planted for stocks, and allowed to grow one year. These were headed down early in the winter and grafted.

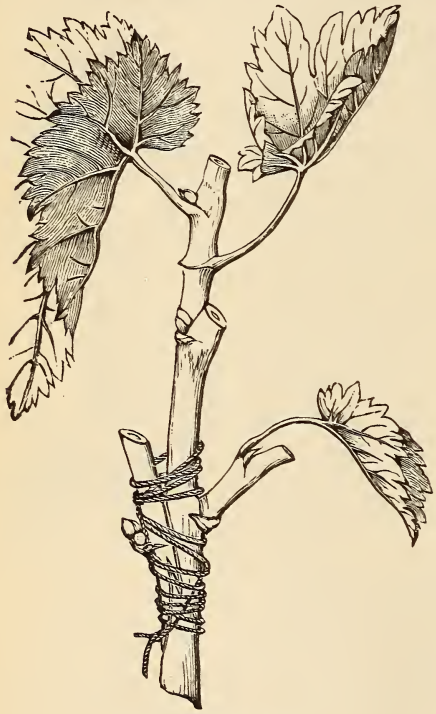


Fig. 9.—Whip Graft.

Fig. 10.—Bottle Graft.

Bottle Grafting.—Another excellent and still more certain method is what is termed "bottle grafting." The preparations are in every way similar to those recommended for whip grafting; but instead of putting on a short scion, a piece of ripe wood, a foot or more in length, is placed in a bottle of water, and the union is made as follows:—With a sharp knife take a good slice, four inches in length, off the side of the graft, commencing at two

buds below the top. Then take a corresponding piece off the stock, notch the two together as in whip grafting, bind tightly, and apply a little clay or grafting-wax, which some prefer, as being less likely to hold moisture, and so retard the union by inducing the formation of stem-roots. When the vines intended for grafting are very strong, they should be allowed to get into full growth before the grafts are put on, and the latter should be placed in the house to swell the buds at least a fortnight before the operation is performed. By this means grafts can be attached to any part of a bearing vine, as the bottles, which should be kept constantly full of soft water, can be suspended from the trellis; but the most satisfactory result always follows grafting on one of the principal canes through which the sap flows freely. It is no unusual occurrence for a well-selected graft to burst the bottle with its roots, and to carry a bunch of good grapes from the second bud the first season, while the first or terminal bud is throwing up a leader capable of overtopping twenty to thirty feet of rafter.

Inarching, or Grafting by Approach.— This method of transferring a new variety to an established vine is very often resorted to by private growers, when it is inconvenient or impracticable to plant in established borders already well filled with roots.

The operation is so simple and easily understood that it is only necessary to say the stock and scion should be started at the same time and brought on together. When strong enough, the latter, which is in a pot, is placed in a convenient position for uniting with the stock. This is done by taking a thin slice of the green bark off each shoot and binding them together with soft bast. A few days will be sufficient to form the union, when the ligature may be loosened, but not entirely removed, lest by accident or strong growth the tender union may be disturbed. When thoroughly established, the stock may be cut back to within one or two buds of the union, but not nearer, as protecting ties should be kept above and below until the end of the season. As soon as the union is complete, and the young growth shows by its strength that it is deriving nourishment from the stock, it may be partially cut through below the working, and eventually detached from the pot vine.

Budding. — The best time to bud the vine is when the young wood of the current year has attained its full size, and is beginning to change colour for ripening. The variety from which the buds are to be taken should be equally advanced, as the latter must be full, plump, and well formed, with a good fresh leaf at the base. Unlike the Peach or the Rose, it is not necessary to remove the wood from the shield, provided the latter is taken off rather thin, and the union with the stock is very neatly and accurately made, by taking as much bark and wood off the stock as will admit of the cambium of the two coming into close contact with each other. In order to secure success, the operation should be expeditiously performed on a dull day or evening, otherwise the bark of the bud will get dry and the latter will perish. When properly placed, the buds must be firmly tied with soft bast or yarn (Fig. 11), and a little damp moss placed above and below, but not covering the bud, will keep the leaf-stalk fresh until the union is complete.

When the vines show signs of ripening off their foliage, and there is no longer any danger of the bud, which is to remain dormant all the winter, breaking into growth, the shoots beyond must be shortened back to within one or two eyes and dressed with styptic at pruning time.

When the vines break in the spring, the one or two eyes beyond the bud will require stopping at the second leaf, and as soon as the inserted bud gets into free growth, their entire removal will be advantageous.

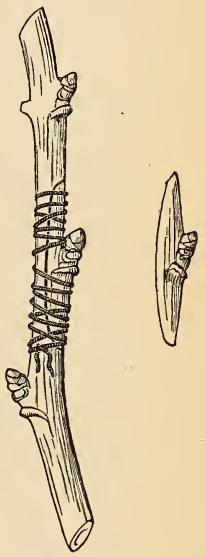


Fig. 11.—Budding.

If it is thought desirable to insert a number of buds on the whole length of a young cane, they can be introduced alternately about twelve inches apart, great care being observed in the preservation of the buds and foliage of the vine so operated upon, as well as of the leaves of each bud. When all is finished, a little light shade and gentle syringing for a few days, to keep the moss and foliage damp, will facilitate the union.

Green-budding.—Experiments have proved that buds in a state of semi-ripeness may be successfully inserted on shoots of the current year which have attained their full size, but are not so ripe as to be past "running"—a term well understood by the craft, but which may require some explanation for the benefit of the amateur. In other words, the sap must be sufficiently active to admit of the bark parting from the wood after an incision has been made with a sharp knife. It is important that the

eyes be perfectly formed and firm, as it is not necessary to remove the wood from the interior of the shield, as is the case when budding the Rose.

Having procured the buds, make a longitudinal cut, an inch or more down the stem, then make a transverse cut across the stem at the top of the first incision, raise the bark on each side with great care, then take off the bud with a thin slice of wood adhering, force it into position, make a clean cut at the cross-incision, and bind tightly with bast or yarn (Fig. 12). Keep the buds slightly shaded and moist by frequent damping with the syringe; but do not remove the ligatures until after the leaves fall from the vines.

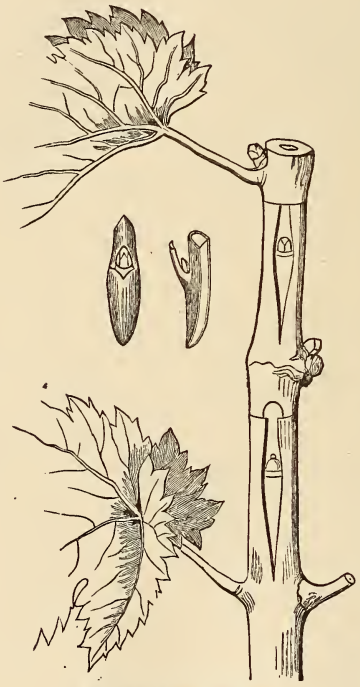


Fig. 12.—Green-budding.

Planting (Yearlings).—If one operation in vine culture has undergone more changes than another, it is unquestionably that of planting. Years ago, it was the practice to incur great expense in the preparation of broad, deep borders for the external planting of one-year or perhaps two-year-old vines. These were allowed to make a year's growth, which was cut down to within a few inches of the starting bud, a second year's growth was treated in like manner, and the third year's rods were considered strong enough to carry a few bunches of grapes.

Modern growers, who propagate, plant, and fruit their vines within two years from the eye, pooh-pooh the slow process, by which our forefathers built up the fine old vines still existing in many parts of the country, and from which, notwithstanding the fact that their ages range from forty to fourscore years, heavy crops of the finest grapes are still being cut. They plant and re-plant; but still the Leviathans exist; a fair proof that the premature fruiting of vines means a short life and a hard one, which may and does suit the grower for market who works for quick returns, but it is not quite the system that can be recommended to the proprietors of private places, who look upon their vines as heirlooms, and object to the frequent disturbance and replanting of their borders.

While admitting, however, that the old system is slow and the new one fast, it is by no means difficult to draw a line between the two, which will enable the modern grape-grower to frame the outlines of old vines, and at the same time to vie with the express grower, who is straining every point to keep pace with the times. Assuming, then, that the front of a vinery or range of vineries has been built upon arches or piers, to admit of internal planting, that it is the intention to use vines which have been grown from eyes and ripened off into what are termed "planters," by the end of August, there are two courses open to the cultivator. He may either plant at once, before the vines go to rest, or defer it until the spring. The best months in which to plant ripe canes are September and October, February and March; the most unfavourable months are November and December.

If the vines must be obtained from a nursery, they should be secured early, and placed where they can be safe from drenching rain, wind, and worms. If intended for autumn planting, and the new inside borders are ready, they may be shaken out at once, say in September or October, and after carefully examining the roots, to ascertain that they are fresh, healthy, and free from Phylloxera, they may be planted a foot or a little more from the front sashes; very shallow and well elevated, to allow for the subsidence of the new compost. Rich, light compost, consisting of turf, bones, and charcoal, or charred refuse, without manure, answers best. Give a little water to settle the soil about the roots, and mulch with half-rotted manure, to keep in the warmth and moisture.

Some grape-growers think a season is saved by autumn planting, while others aver the vines make better growth the following year by being cut back in October, and kept in the pots until February, the most natural time for the mutilated roots to establish themselves in newly introduced fermenting soil. The latter course having been decided upon, each vine should be cut down to within eighteen inches of the pot (Fig. 13) early in the autumn, to prevent bleeding when the sap begins to rise again. When

the borders are ready in February, and the buds show signs of swelling, turn out the vine, soak the ball in tepid water, wash away all the soil, and place it in position on the surface; secure it at the base with a strong peg, and after cutting away all damaged roots, cover lightly and give a little water at a temperature of 90°. Place a neat stick to each vine for future use, as the young canes will have to be trained up to the trellis from the very lowest buds at the base, provided they are fully exposed to the influence of light; but if they are likely to be shaded, then buds higher up the stem must be selected for making the new canes.

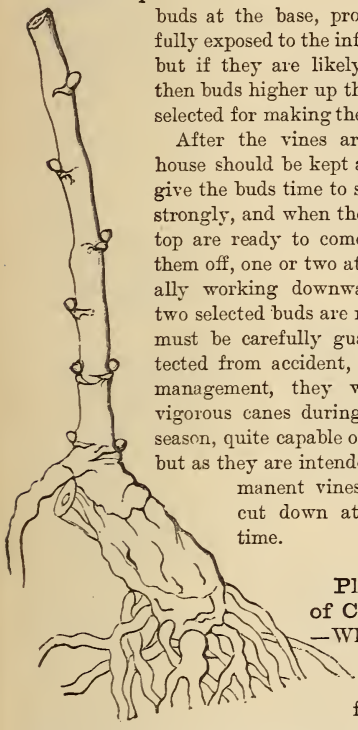


Fig. 13.—Young Vine from an Eye cut back ready for Planting.

After the vines are planted, the house should be kept at temperate, to give the buds time to swell and break strongly, and when those nearest the top are ready to come into leaf, rub them off, one or two at a time, gradually working downwards until the two selected buds are reached. These must be carefully guarded and protected from accident, as, under good management, they will make two vigorous canes during the following season, quite capable of bearing fruit; but as they are intended to make permanent vines, they will be cut down at next pruning time.

Planting Eyes of Current Year.—When planting young growing vines from eyes of the current year, it is not necessary to break the balls, provided they can be carefully turned out of the pots and placed in the warm compost before the roots begin to coil round the insides. This, it is hardly necessary to say, can only be practised by those who have convenience for propagating their own vines, and where the fronts of the houses are placed upon piers or arches to admit of internal planting.

Neither is it advisable to plant until the sun has gained sufficient power to produce a genial day temperature, without having recourse to much fire-heat. If propagated in February, nice young vines will be ready for planting out in May or June, with every prospect of their filling the house with stout, short-jointed canes by September, when fire-heat will be necessary to ripen up the buds. Some plant as late as July, but May is perhaps the best month.

It is much to be regretted that all private grape-growers have not the convenience to propagate and grow on their young vines from proved varieties. The introduction of that most terrible pest, the Phylloxera, would then be avoided. None but the best eyes would be used in the manufacture of their stock, which could be kept steadily progressing until the new borders, in a state of fermentation, were ready for them. Planting, either from pots, or better still from the square sods of turf, could be accomplished at pleasure. There would be no looking back, and the feat in which only the favoured few now succeed would soon become more common. It is quite true the trade growers would supply spring-struck plants in a growing state; but where long distances separate the raiser from the planter, their removal would be attended with great risk, and very often the sudden check would end in failure.

Distance at which to Plant.—Assuming that the house presents eighteen feet of rafter, and grapes are wanted as speedily as may be consistent with the future well-being of the vines, those intended to remain for a number of years should be planted five feet apart in positions favourable to leading the rods under the centre of each light, in preference to training them under the heavy rafters of old, sash-roofed houses, as the pruning-buds on every spur then get the benefit of light and heat, so essential to their perfect maturation. Supernumerary vines may then be introduced, one in each opening, to give a few grapes the following year. If planted inside and well managed, every rod will fill its allotted space, the permanent vines will be cut down to the lowest wire in the trellis in December, and the supernumeraries will be left six to eight feet in length to carry a crop of fruit, when they will be destroyed to give full scope to the permanent vines.

If rigidly carried out, this theory answers very well in practice; but, unfortunately, experience justifies the assertion that many good grape-growers have broken away from their good resolutions, and have become faint-hearted when the time has arrived for taking every alternate vine away. To all such cultivators and planters, as a strong adherent to the extension principle, my advice is, enter not into temptation by planting surplus vines, as overcrowding leads to disappointment and premature exhaustion.

Varieties of Grapes.—The varieties of grapes now under cultivation being so numerous, a description of all of them would extend these pages far beyond the limits placed at our disposal; and not-

withstanding the fact that each variety possesses some good quality, it is not practicable, neither is it desirable, to attempt the cultivation of more than a tithe of them in any private garden. In order to keep up a constant supply of first-class grapes all the year round, not less than four houses should be employed; and if six are at command, varieties requiring special treatment can be much better grown than when they are mixed up together. These houses would include:—

No. 1.—For early forcing, in which the fruit would be ripe in April and May.

No. 2.—An early summer vinery, for carrying on the supply through June and July.

No. 3.—A large mid-season house, in which several varieties are generally grown.

No. 4.—A Muscat house, for giving a supply of this delicious grape from August onwards.

No. 5.—A late or autumn Hambro' house, for keeping up the supply until Christmas.

No. 6.—A large late house, in which such kinds as Lady Downes and Alicante are grown for bottling at Christmas, to carry on the supply until new grapes come round again in April.

If properly arranged, no great number of kinds are required to maintain this constant supply; and, as every grower wishes to have the best, a selection from the following will be found adequate to his requirements. It is hardly necessary to say the quantity must be regulated by the demand; as, for instance, where very early and late Muscats are required, two houses should be devoted to their culture, and double that number to the universal Hambro', which all grape-growers look upon as their never-failing sheet-anchor.

Grapes for No. 1.

1. Black Hamburgh.
2. Madresfield Court Muscat.
3. Foster's White Seedling.
4. Buckland Sweetwater.
5. White or Grizzly Frontignan.

No. 2.

1. Black Hamburgh.
2. Madresfield Court Muscat.
3. Foster's White Seedling.
4. Buckland Sweetwater.
5. Gros Colmar.

No. 3.

1. Black Hamburgh.
2. Madresfield Court Muscat.
3. Alicante.
4. Gros Maroc.
5. Gros Colmar.
6. Foster's Seedling.
7. Buckland Sweetwater
8. Black Morocco.
9. Duke of Buccleuch.

Nos. 4 and 9 being somewhat capricious and in some places difficult to manage, one vine of each should be planted first to ascertain if the soil suits them. Although not so rich as some, they are very fine, handsome, and worthy of careful trial.

No. 4.

1. Muscat of Alexandria.
2. Bowood Muscat.
3. Mrs. Pince.
4. Mrs. Pearson.

No. 5.

1. Black Hamburgh.
2. Alicante.
3. Gros Colmar.

No. 6.

1. Lady Downes.
2. Mrs. Pince.
3. Black Morocco.
4. Alicante.
5. Gros Colmar.
6. Alnwick Seedling.
7. Gros Guillaume.
8. West's St. Peter's.
9. Mrs. Pearson.
10. White Tokay.
11. Trebbiano.
12. Raisin de Calabria.

Grapes for Fruiting in Pots.

1. Black Hamburgh.
2. Madresfield Court.
3. Foster's Seedling.
4. Buckland Sweetwater.
5. White Frontignan.
6. Royal Muscadine.

Grapes for Green-house.

1. Black Hamburgh.
2. Madresfield Court.
3. Royal Muscadine.
4. Foster's Seedling.
5. Alicante.

Grapes for Market.

1. Black Hamburgh.
2. Madresfield Court.
3. Lady Downes.
4. Alicante.
5. Gros Colmar.
6. Muscat of Alexandria.
7. Alnwick Seedling.
8. Trebbiano
9. Foster's Seedling.
10. Gros Maroc.

Grapes for Quality.

1. Muscat of Alexandria.
2. Madresfield Court.
3. Chasselas Musque.
4. Frontignans of sorts.
5. Dr. Hogg.
6. Venn's Seedling.
7. Muscat Hamburgh.

Grapes for Exhibition.

(Black.)

1. Black Hamburgh.
2. Madresfield Court.
3. Alicante.
4. Lady Downes.
5. Gros Guillaume.
6. Gros Colmar.
7. Gros Maroc.
8. Alnwick Seedling.

(White.)

1. Muscat of Alexandria.
2. Bowood Muscat.
3. Trebbiano.
4. Foster's Seedling.
5. Buckland Sweetwater.
6. White Tokay.
7. Mrs. Pearson.

Nos. 1, 2, 4, and 5 are the best. When more than four white varieties are wanted, one each of 3 and 6 may be grown. No. 6 is an excellent old grape, but requiring as much fire-heat as the Muscat, to which it is inferior, it is not generally grown.

Everybody's Grapes.

1. Black Hamburgh.
2. Madresfield Court.
3. Alicante.
4. Black Frontignan.
5. Black Prince.
6. Muscat of Alexandria.
7. Foster's Seedling.
8. Royal Muscadine.
9. White Frontignan.
10. Buckland Sweetwater.

Grapes which Produce the Largest Bunches.

1. Gros Guillaume.
2. Black Hamburgh.
3. Trebbiano.
4. Syrian.
5. White Nice.

Grapes of Remarkable Character.

1. Aleppo. The striped grape.
2. Black Corinth. The Currant of commerce.
3. Black Monukka. The seedless grape.
4. Ciotat. The Parsley-leaved vine.
5. Ferdinand de Lesseps. The perfumed grape.
6. The Strawberry grape, so called from its scent.

GROUND OPERATIONS.

DRAINAGE IN PRACTICE.

HAVING considered the main principles on which drainage rests and should be conducted, this chapter will be devoted to the explanation and illustration of its practice. The chief points are the direction, distance apart, depth, fall, sizes, materials, outlets, tools for making, actual cutting, and laying of the drains.

Direction or Line of Drains.—This is a point that, above all others in draining, needs the assistance and advice of civil engineers or experienced drainers. Perhaps the most common method is that of running the drains parallel with the line of level or even fall of the ground. This mostly answers well where the soil and subsoil are of equal depths and uniform quality throughout; but in many cases this mode of draining is almost useless on account of the difficulty of securing a fall. And besides, as already observed, a single or few drains so placed as to intercept the overflow water from higher levels, will cut off lower springs, and so dry at times without more trouble the whole of a field or garden.

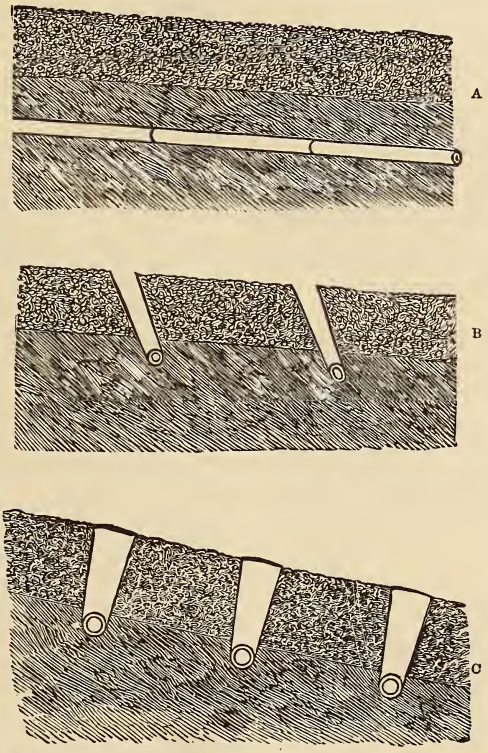


Fig. 12.—A, with the slope; B, obliquely across fall; C, drains at right angles with fall.

There are other advantages at times in draining obliquely across the incline of the land, such as the more equal distribution and slower removal of the water from the surface tilth. Bearing in mind what has been said on the chemical, cultural, and mechanical importance of water in motion through the land, it will be obvious that it might prove far from advantageous to remove it too rapidly; provided it moves, most of the advantages of drainage will be secured, and the slow motion may prove far better than a rapid run. The popular idea, that the faster water is discharged from the mouths of the drains after a shower the better, may not by any means prove correct. Drains that discharge muddy water in their haste, may impoverish almost as much as enrich the land. In the three illustrations here given, that of draining with the slope, at right angles with it, and obliquely across it, the latter will mostly be found the best. Some, however, prefer the line of the slope as being at once the more simple and easy, and there can be no question that the major portion of common tile-draining in fields follows the line of the surface soil or subsoil.

Distance Apart of Drains. — This is considerably influenced by their depth, as, unless in the most tenacious clays, the deeper the drains the more land will they lay dry on either side of them. Hence the advocates of very deep drains, such, for example, as from four to five feet, mostly couple the extra depth with extra distances apart. A yet safer and more sure criterion of proper distance may generally be found in the character of the soil; the more tenacious the latter, the closer in reason the drains should be to each other; the more porous, the farther apart. There are, however, exceptions to the latter rule, for not unfrequently the excessive moisture in porous soils rises up from below, and may need interception and removal by a system of closely-placed drains. The extremes of distances may generally be found between twelve and thirty feet. The latter may not prove too far apart on good porous soil; the former is seldom too close on stiff tenacious clays. Fifteen, eighteen, twenty, and twenty-four feet are popular distances.

Of course these distances refer to the collecting or feeding, and not the main drains. One or more of the latter will generally be found sufficient for a garden. They should be placed at the lowest point, be larger and have a sharper fall than the others. All the secondary drains should enter the mains at easy angles or curves, as shown in Fig. 13. This simple expedient is one of the surest means of pre-

venting the mains from being silted up, as too often happens when the collecting drains enter the discharging mains at right angles. In cases where the main may be carried along almost in the middle of the area to be drained, no two tributaries should meet opposite to each other, as shown at Fig. 14, as then the two currents might about neutralise each other, and a deposit of silt be left in the main, the natural legacy of two currents, of almost equal strength, meeting at right angles.

The Depth of Drains.—Much, as has already been hinted, depends on the local soil and subsoil; and where the system of cutting off the subterranean excess of water is adopted, very deep drains

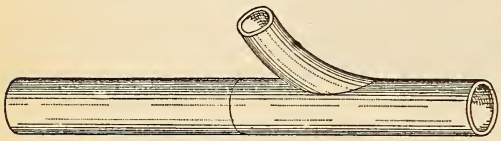
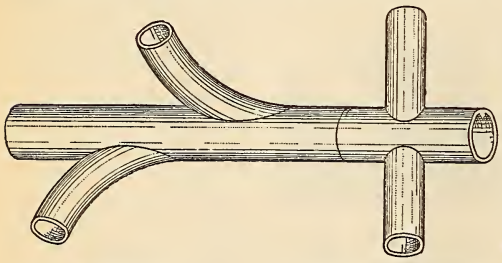


Fig. 13.—Angle of Secondary Drain.

may sometimes prove the most efficient. All garden drainage should also be deeper than that of fields. The tilth, the cultivation, the roots of the plants, are all far deeper in the garden, and hence the absolute necessity of deeper drains. In addition to this, fruit gardens should be more deeply drained than vegetable, though the roots of the latter will occasionally find their way into and block up drains



Proper Arrangement. Improper Arrangement.

Fig. 14.—Meeting of Tributaries.

a yard or more deep. In all gardens in which fruit or ornamental trees and shrubs are grown, the drains should be at least four feet deep. Allowing a foot or so for the drainage material of stone or rubble drains, this would allow a clear three feet from the surface of the soil to the top of the drainage material. In the case of tile drains, three feet six or three feet nine inches clear would be left between the crown of the tile and the surface of the mould. But for the expense another foot might very well be added to the four here recommended for garden drains, as garden tilths, especially those devoted to the cultivation of the best vegetables, can hardly be too deep, nor rich; and by the operations of natural laws and the application of manures, the tilths have a tendency to grow as deep as the drains.

Frequently, too, the depth has to be curtailed, owing to the fact that the natural outlets—that is, ditches, streams, or rivers—are so exceedingly shallow. It is generally an expensive operation to deepen these, not seldom impossible; and hence the natural outfall must too often be made the measure of the depth of the main drains.

Unless this is found sufficient it should never be accepted as the only possible outfall without testing and trying for a lower one; and, indeed, the depth and direction of the main drain should always be determined first. This found, and the general average elevation of the land to be drained also ascertained, the possible depth of the drains becomes a mere matter of calculation.

If sufficient depth and to spare is found to exist, it is easy to choose out of this excess; but if a useful depth cannot be commanded, some other lines at a lower level must be found for the main drains.

Fall of Drains.—The exact ratio of falls is really of little moment so long as the water runs, and the choice of any special fall, as a quarter or half an inch to ten feet or twenty feet, is seldom completely in the power of the drainer. Where the drains are made parallel with the fall, they simply follow the same level, or nearly so, as, of course, it would be undesirable or mischievous to follow the ups and downs of any trifling surface irregularities. In these cases the workmen are mostly provided with a stake furnished with a cross-bar across the top to keep it on the exact level of the surface. (See Fig. 21.) By placing a second cross-bar across to indicate the width of the drain, a handy test of the correct size and depth of the drain is always on the spot.

A very simple way of securing an even fall in the bottom of drains where the surface is uneven, is to use long borning-stakes with cross-bars, as already described. Place one permanently at the farther end of the drain, or at any handy distance where the level has been already ascertained; place another on the tiles already laid; and the third against the work proceeding. If the three can be sighted at once the drain has the proper fall. Another way is to find the entire fall from one end to the other; calculate how much that amounts to for every ten to twenty feet; nail or screw a piece of wood on to one end of the straight-edged spirit or foot-level, and place this end on to the lowest part of the drain. When the

plummet or spirit-level beads or stands true, the fall will be regular from one end of the drain to the other. As it is exceedingly awkward to get any level into the bottom of a drain, or to use it when there, borning-rods may be used, and the straight-edged level placed on the top of their cross-bars, with the addition suggested; the thickness of the splice may be so adjusted as to give a regular fall throughout any length of drain. The fall should invariably be regular throughout, with this exception, that the drains should discharge themselves into the main or outlets at a sharper fall, and consequently with greater speed, than they run through any other portion of their course. This simple expedient is one of the surest antidotes to silting up and blocking the mouth of the drains, secondary or main.

Sizes of Drains.—The efficiency of drains is not seldom in the inverse ratio of their area. The smaller the more efficient, when well made, and possibly the less danger of silting up; and drains are only safe against blocks when fairly at work. It has also been found on calculation that inch drains are of sufficient area to cope successfully with any amount of rainfall that we have to deal with in our climate. It is very seldom that more than an inch of rain falls in twenty-four hours. This amounts to something like one hundred tons to the acre, and inch drains could easily discharge this in eighteen or twenty-four hours. It has been calculated an inch drain can readily discharge half a ton of water per hour. As there are twenty-four hours in a day, and generally several drains in an acre, it is easy to see that even the smaller drains are not likely to be over-freighted for any length of time with an excess of water. Any small aperture can pass an enormous amount of water through it in a given time, especially when, as in the case of full drains, the current is strong and the motion perpetual so long as there is any water to move.

However, in gardens in which the permanent crops forbid a repetition of drainage, it is well to use tiles of two or even more inches for the drains. Three-inch mains, and an inch and a half or two inches for feeders are, however, amply sufficient. The tiles may be either round (Fig. 15), horse-shoe (Fig. 16), or elliptical, the form matters little. Open horse-shoe tiles, laid on a *movable* sole, are also used at times (Fig. 16). These are in nowise better than the horse-shoe tile made in the usual way. Superior tiles, especially those used in the mains, are also generally made with sockets; that is, the one end of each pair of tiles slips into the other (Fig. 17). These, however, cost more, and are not much believed in by practical drainers. Where the subsoil is stiff, and the point of union between the pairs of tiles is clayed over, the drain is moulded into a union throughout, and seldom or never gets blocked up.

Several Tiles in One Drain.—The introduction of two or more small tiles to take the place of one larger tile is a very old method of draining. Illustrations of two such drains are given. There is no objection to the piling together of tiles in the bottom of drains, only the expense. In Fig. 18, No. 1 shows a drain cut out with an elbow, with one tile on the bottom. No. 2, a drain bottomed with the horse-

Fig. 15.—Common Round Drain-tile, without Socket.

shoe tiles, the bottom one inverted; and No. 3 is finished with three tiles of the same shape, the upper one resting on the two lower. The last two drains are made somewhat wider to receive these additional tiles.

Stone drains again, as Nos. 4, 5, 6, 7 (Figs. 18, 19), are made of different forms as well as sizes. The Box drain, No. 4, derives its name from its form.

Fig. 16.—Horse-shoe Drain-tile, with Movable Sole.

Where sand, flint, or other stones, easily split or broken into slabs, abound, there is no drain more easily made, few more efficient. The Angle stone drain, No. 5, consists of a single or several large stones for a base, on which two pieces are set to form the point of a triangle in the centre of the drain. The vacant spaces on either side of the angle are filled

Fig. 17.—Common Round Drain-tile, with Socket.

full of rubble or rough stone, and these are disposed in the best possible position for the rapid discharge of water into the drain. Fig. 19 shows the more common rubble or flint drains, filled up to different depths. This description of drain should average a foot in depth, and from six to nine inches in width.

It is needful to make stone drains of larger area than those of tiles, as the danger of silting up increases in the direct ratio of the amount of such drainage material as broken stones, and thus the

question of size brings us to another point of much moment.

The Materials used for Drains.—There is a general consensus of opinion that tiles are the best materials. Among their other merits some also think them warmer than stones. Either, of course, quickly become assimilated to the temperature of the soil, but as stones conduct heat faster than tiles, they feel colder, and hence the origin of the fancy that stone drains are cold. Doubtless, next to tiles there is nothing like good sound stones for drainage. They should, however, be fresh and good, and of as nearly as may be uniform hardness and quality. The land pickings, and general collections of builders' rubbish and effete brick-bats, &c., sometimes used for drains, are very inferior to chalk, flint, river or sea shingle of sufficient size, or the refuse or inferior stones of the quarries. These may be used of considerable size, especially towards the bottom of what are called rubble drains. The rough stones keep the water-course open, maintaining a free course for the water as in the case of box, angle, or tile drains; while the smaller stones at succeeding elevations, and the yet smaller on the surface of the drain, act as percolators, and also as barriers to the passage of silt into the drains.

To make security doubly sure against these blocking tendencies of the soil, a thick turf is often inserted over the upper layers of fine stones, or a thin covering of straw is placed over these or the tiles. Buried thus, the straw will last long enough to keep the soil out of the drains until it (the soil) has once more become so consolidated as to form an indestructible arch over the drainage material, which, though not impervious to water, is to the passage through of any sand or silt.

So strong does this domed soil over the crown of drains, especially if of a semi-tenacious character, become, that it is no uncommon thing to meet with drains that have been excavated for fifteen or twenty years, and merely filled in with a little brushwood or straw, still retaining their form, and discharging their drainage functions, years and years after the perishable materials had disappeared and been washed away.

Fagot, Furze, Brush, and Straw Draining.—These are, or rather have been, practised very extensively where stones are scarce, and where no other hard material abounds. They are fairly effective and durable, but are altogether out of character and form for garden purposes.

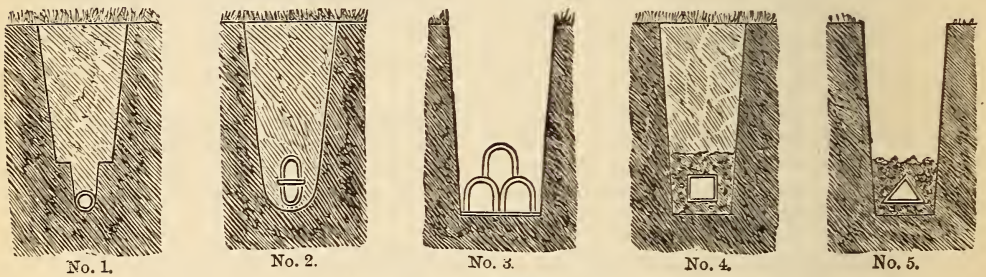


Fig. 18.—Various Kinds of Drains.

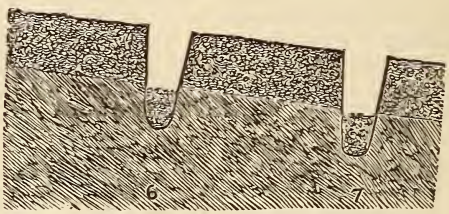


Fig. 19.—Rubble Drain.

Turf Drains. — The same may be said of these, but they answer well in old meadows, where the turf is thick, fibrous, and strong. It used to be cut almost two inches thick and securely placed on the artificial ledge cut out for it near the base of the drain, the base section being made as narrow as possible, as in No. 1, Fig. 18. It is said on good authority that some of these drains have lasted sound and good for periods so prolonged as from twenty to thirty or even fifty years. By this it must not, however, be understood that the turf lasts so long as that—only that the earth has formed a solid arch over it, and the drain keeps running.

But none of these perishable materials should find any place in garden drains, as in these only the best and most desirable ought to be used.

Outlets.—It is hardly too much to say that the weakest parts of drains are in their outlets. Great care and trouble are often expended in the planning

and execution of the drains, and only the best materials are used; but so soon as the nearest waterway is reached the drains are run into it, very often on the level, and not seldom under it. Many times it is in flood, and, of course, unless the water has free course from the mouth of the drains, the drains themselves are useless. They are not merely stopped for the time being, but disorganised throughout their entire course. For flooded drains become weak as mud, and almost as difficult to keep level or on an even fall. Hence, so soon as the flood permits them to run they often get out of level, and are thus rendered totally useless.

The Tools for Making Drains.—These are both special and numerous. The spade is the chief or only tool needed to make stone drains. A deep furrow was taken out with a broad-moulded plough, and from this part the spade did the work, cutting it down square and even, and to a depth of two or more feet throughout, narrowing to a foot or eighteen inches at the base. But with the introduction of tiles a whole family of draining tools has sprung forth. The purport of most of these is to cut or scoop out the drain as deeply as wanted, while keeping it as narrow as possible. To this end spades little wider than chisels are used in some

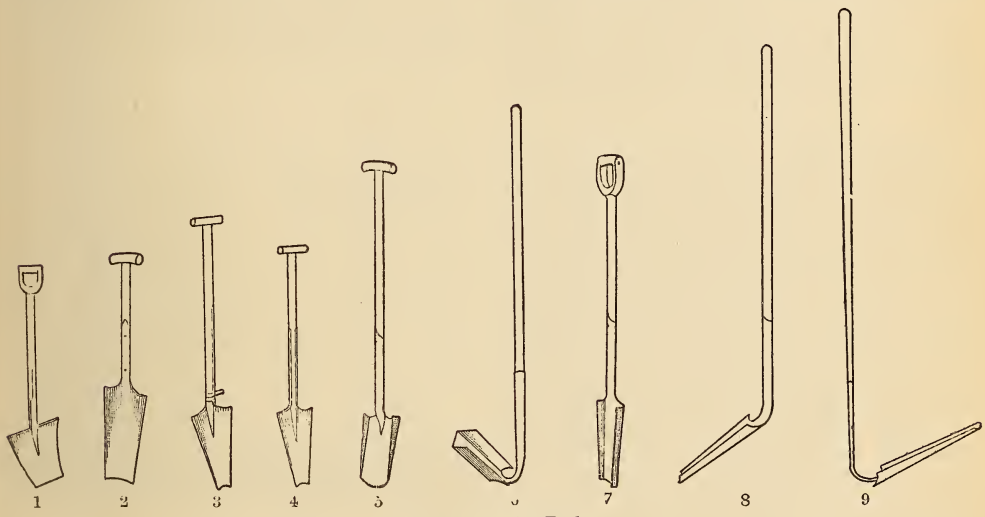


Fig. 20.—Draining Tools.

Another great fault in regard to outlets is that they are so often left without any grates or guards. Those who have had experience of the enormous injury inflicted on drains by rats and other vermin that find lodging and breeding-grounds there in dry weather, and by their persistent efforts burrow their way under or out of them, to the partial or complete disruption of the drains, will be sure to protect any outlet that comes to the light with wire or other vermin-guard. Where drains discharge from the side of a high bank, a very simple mode of protection consists in running a long tile some way beyond and clear of it. These projecting tiles baulk the rats; but they are in danger of being broken off or pulled out by hedge-trimmers or other accidents. So that on the whole there is nothing, perhaps, to equal wire guards or iron gratings for the outlets of drains.

It is also most important to keep these outlets clear of silt and other weeds, as either or both frequently cause serious and most injurious blocks.

parts of the drain, and scoops or spoons with long handles follow these into deep narrow spaces, where no man could find room to stand or use a spade, however narrow. No. 1 (Fig. 20) is about the widest spade used in draining. It is mostly made more or less bent, but this is not material, and a common spade might just as well be used. No. 2 is a most useful spade to follow the first, and is succeeded by Nos. 3 and 4. No. 5 represents a round-pointed shovel, turned up at the edges, which is very handy for getting out the crumbs, that is, the pieces that fall off the full spadeful in the lifting. No. 6 is a similar tool mounted on a long handle, to be used under the work. No. 7 is one of the narrowest spades used in drainage, and is bent in so much at the sides as to form almost a semicircle, and Nos. 8 and 9 are similar-shaped scoops or spoons placed at different angles. There are several others occasionally used; but these will suffice to give those interested in the practical performance of drainage

some clear idea of the nature of the work and the character of the tools needed for its performance. In general terms, the lower portions of drains are wholly excavated by such narrow tools as Nos. 3, 4, 5, 6, 7, 8, and 9. Such tools not only reduce to a minimum the amount of earth to be moved, but by reducing the width of the drain to the narrowest possible area, the tiles are gripped firmly by the solid soil on either side of them and held immovable as in a vice. It is impossible to over-estimate the importance of this in insuring the stability and consequent permanent efficiency of tile drains. A horizontal displacement of half an inch would reduce the discharging power of inch tiles one half; displace an inch, and the drain would be blocked or stopped. Hence the vital importance of a narrow base for drains, and a firm wall of earth on either side of the tiles.

Solidity of Base.—This is the most important in all drains, but very much more so in the case of tiles than of those formed of bushes or stone. In the latter an inch or two of subsidence here or there is of less moment, though it may prove a serious danger in any sort of drain. But with tiles of such narrow bore, the danger increases as the tiles diminish in size, until with inch only, the most common of all for drainage, it becomes most serious. It is not so imminent in gardens as in fields, as in the former, pipes of one and a half, two, two and a half, or even three inches are often used. But it is equally important that in all drains the utmost care should be taken to leave the base-lines that receive the tiles or drainage material undisturbed. To this end great care should be taken with the bottom spit not to pierce the soil or subsoil one atom beyond the tile-sole, for once the ground is disturbed no future attempts at consolidation can restore its primitive hardness. It is far better to leave an inch or two at the base to be scraped out with the spoons, No. 7 or No. 9. Occasionally, too, faults, fissures, or gullies will be found in the bottom of the drain. These should be filled in with stone or solid earth, and made so solid that there should be no fear of future subsidence. Tiles may also be had to order of several times the ordinary lengths, so as to span over soft spots or flaws in the strata, their ends resting on the solid soil on either side.

Figs. 21 and 22 are simple contrivances to measure the size or depth of drains. Fig. 22, with its three cross-bars, keeps the section of the drain from base to summit of regular form throughout. Fig. 21 merely measures the depth, the cross-bar at top resting on the surface on either side. This may readily be made movable, so that this simple contrivance would measure the depth of any drain, and in cases where the surface has an even fall, it answers all the purpose of a level, and no other will be needed. Fig. 23 is the tile-layer, the long handle enabling the drainer to reach the bottom of the drain with the tile on the holder c. It is astonishing how rapidly tiles can be well and truly laid by this handy contrivance in the hands of a skilful workman.

The Actual Cutting and Laying of the Drains.—But little remains to be advanced on this part of the subject, as it has been incidentally referred to in the description of tools. There is one very useful lesson in drainage operations that landscape and other gardeners may with much

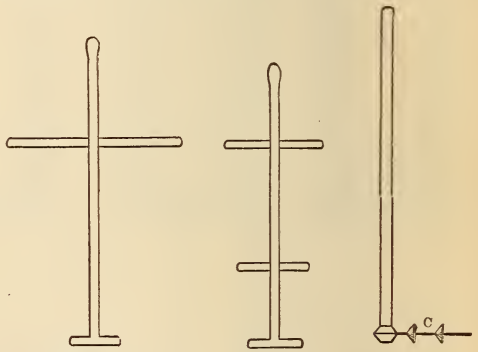


Fig. 21. Fig. 22. Fig. 23.

Fig. 21.—Stick with Movable Cross-bar for Measuring the Depth of Different Drains. Fig 22.—Stake with Movable Cross-bar, and also Cross to Measure Width of Drain. Fig. 23.—Tile Layer.

profit take from farmers. Wherever drainage operations are extensive, it is so much cheaper, as well as better, to have the plough remove the first spit of the soil. Having decided on the lines of drains, a good ploughman will draw the lines sufficiently straight and at regular distances without more ado than the placing of a few poles at the end of the land to be drained. A good section of earth is also removed at the least cost, and the workmen having got their work laid out before them, there is no loss of time in starting. This should always be done, the tiles laid handy and convenient, the fall per ten or twenty feet determined upon, and all adjustments of simple working tools and tests provided before starting. The advantages of all these preliminary arrangements will result in the second spit being thrown out before the first would have been settled about under ordinary haphazard ways of going to work.

When the space is too limited or confined for the plough, the drains should be all carefully set out,

the lines, falls, and outlets seen to before beginning the work. As a matter of procedure, it is also most important that the main drain and outlets should be made or altered, if need be, before any attempt is made to lay the collecting or feeding drains.

Another practical detail of great moment is to begin digging at the lowest end of the drains. The water will then clear itself by running into the outlet or main, and the running water on the heels of the drain-maker will make the work easier, as well as afford impromptu proof on the spot of the correctness of the level and the efficiency of the work.

Experienced drainers, testing their work thus as they dig, not seldom lay the tiles as they proceed, and pass over the major portion of the soil on to the newly-laid drain, instead of pitching it all on to the surface in the usual way.

Horticultural drainers, as a rule, however, mostly like to see a considerable length of their drains clear before laying them, so as to make sure of the discharge of the water. This practice, however, carried to excess, as it often is, by laying the entire length of the drain open before tiling or covering, not only involves the risk of the sides falling in, but the flowing water in the base becomes a source of weakness, and is apt to cause future inequalities of level, and thus injure or ruin the drain. Hence the importance of tiling and filling in as rapidly as possible.

No stones nor any hard or porous materials should be placed over the tiles. Many amateurs in the art of draining seem to reason and act as if it were impossible to have too much of a good thing. Hardly have they laid the tiles till they tumble in all manner of stones or other hard rubbish upon the top of them. Nothing is more effective in ruining the drains. Not only are these apt to crack or smash the tiles, but to displace and so disorganise them. On light turfy lands the best covering over the drains is a sod from one and a half to two inches thick. On the majority of other lands a layer of the stiffest available soil is the best next to the tiles. If carefully trodden or rammed down, all the better. This binds, almost welds, the pipes into a semi-solid mass of continuous bore. There need be no fear but that the water will find its way into the pipes. It is sure to do so, if not just over them, then down by the sides. Not a few act, in drain-filling, as if the chief purpose of the drains was simply to dry the section of land included in their area. Were that all, or the chief, desideratum, better not make them. The fact is, the drain should remove any superfluous water from the whole area of the tilth, and, what is of much more consequence, keep the water in perpetual motion through its substance and mass. It is as valuable as a circulating as a depleting force, and the recognition of this fact would prevent full half the fallacies existing alike in regard to the theory and practice of drainage.

In laying the tiles great care must be taken to make the ends of the tiles meet as correctly as may be. And of course when inch socket tiles are used, these will be carefully placed within each other, and much care taken all through the process of laying to prevent any stones or clods of earth entering the bore of the tiles. It is well, however, to tread in the earth more or less in the process of filling up, so that most of it may return from whence it came. Three practices, all too common, are named here to be shunned. The first consists in filling in loosely and leaving the soil in a heap over the drain; the second is filling in level and scattering the spare soil all over the land; the third is the placing most of the best soil in the bottom or middle of the open area, and scattering the barren or worthless soil on to the top. The first is unsightly; the second yet more so, as after a time the land subsides, and a furrow on the surface marks the course of every drain; the third clearly marks the drain-spaces with an unsightly and unprofitable line of barrenness. The first two evils may be cured by careful filling in, and the last by the common-sense simple plan of reserving the top spit for the crown of the drain-space.

THE CULTURE OF MUSHROOMS.

By William Earley.

THE Edible Mushroom (*Agaricus campestris*), as it is generally and not inappropriately called, from the peculiarity of its growth, and the esteem it is held in as a comestible, is hedged around with a large amount of interest. Wayward to a degree, as regards its natural growth in our fields and pastures, it has nevertheless been made perfectly amenable to certain studied rules of artificial culture; so much so, that the merest tyro may infallibly grow a crop by accepting these rules, which are very simple, for his or her guidance.

It is the more necessary for us to refer to this subject in this wise, from the fact that, whereas all other kinds of vegetables are produced from either seeds, side shoots, buds, or cuttings, all of which tend to strengthen or afford tangible evidence of a reasonable probability of success in raising and growing future generations of the same kind, the culture of the Mushroom seems rather wanting in such

tangible evidences of certainty of reproduction. The beginner must, therefore, place faith in the result of his buried efforts, whilst patiently waiting the issue.

The Alpha and Omega of Mushroom culture is a good supply of horse-droppings, without which good productive beds are not easily obtained, though we shall show presently that limited numbers may be grown without the aid of this, or any other kindred manure. Along with such horse-droppings stable sweepings may be freely mixed, provided all are moderately dry. It is objectionable to permit other ingredients in liquid form to be mixed with these.

Not only is it necessary to select such dry materials, but it is always desirable to dry them somewhat beyond their primitive state of dampness, by exposing them to sun and air, or during the prevalence of rainy weather by spreading them out, and occasionally turning them over, in a dry, airy shed. As these materials form the nucleus of the future bed, enough must be collected together to form a bed of the desired dimensions. This done, it can readily be seen whether they are moderately dry throughout. If not, another process will have to be undertaken, and it is a necessary one in connection with the preparation of all beds during the winter season, when it is all but impossible to dry the materials sufficiently by any other means. If not dry enough the whole mass must be thrown up into a conical-shaped heap, and be induced to ferment. In process of fermenting steam is given off, which is so much moisture dissipated. The heap must not be permitted to ferment too much or too long, however, else the materials will be destroyed in process of decomposition. It will be necessary, therefore, if the heat is becoming great, with much steam, to turn the whole mass over, shaking it apart freely to cause steam to fly off, re-making the heap into another of conical shape, placing what was the centre of it before on the outside now, and *vice versâ*.

Even in mid-winter, when materials are damp, and the air around highly surcharged with moisture, this second turning of the mass should suffice, and, following the succeeding ferment, the material should be quite ready for bed-making.

Having turned aside to explain how to dry such materials, we will revert to their general use in the cultivation of the Mushroom. Supposing that these needful materials are ready to hand, our attention must next be called to the formation or making of the Mushroom bed, and all the needful additional materials requisite.

Before we proceed with the bed-formation, however, we must first fix upon a site whereon to make it. We will, therefore, turn our attention for a short time to this matter of convenient or proper places for Mushroom beds. And here occurs one important fact, which must rule and determine every decision in regard to them. The bed must rest on a dry bottom, else the spawn will be injured or checked during its preliminary stages of growth by damp arising from the base.

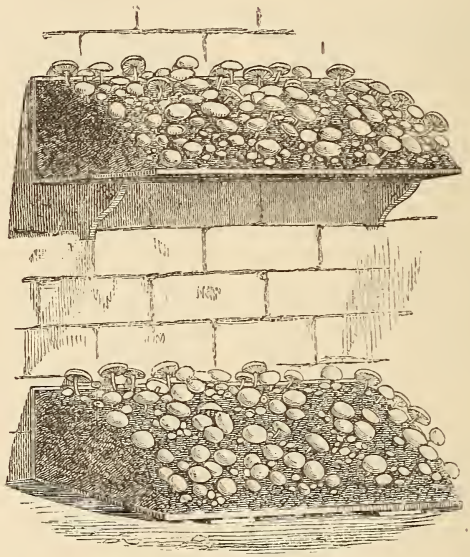


Fig. 1.—In-door Mushroom-bed.

It is quite immaterial whether the site be an elevated one or upon the floor, whether in a light or dark place, moderately warm or somewhat cool and airy, provided it be dry, and in winter one where the thermometer will not fall below a temperature of from 50° to 55°. Any situation in total darkness will suffice, though air should have access to the bed; but even this may be dispensed with, with impunity. Thus an elevated shelf, so boarded as to contain about one foot in depth of these materials, will do admirably.

Where proper Mushroom-houses are constructed this elevated-bed fashion is often had resort to, to economise space. One bed is made upon the floor, up against the back wall of the shed, of the average width of three or four feet; a tier-bed is then built above it, of equal width, and, if room permit, yet another bed above (Fig. 1).

To insure the greatest possible amount of success in connection with such Mushroom houses proper, it is essential that the roof be plastered, and the whole made as air-tight as possible, with the object of

retaining the moisture. Where a certain and constant supply is required, the houses must be warmed by flues or hot-water pipes, the artificial heating media being needful to keep up the necessary amount of heat, and to insure such dampness in the air in connection with it as is congenial to the crops, and this is insured by frequently damping over flues or pipes with tepid water, so as to cause a dense steam to pervade the house. This crop may also be grown in cellars, bins, or boxes, during the winter months, with the minimum temperature above referred to maintained.

All forms of enclosed structures are only suitable for winter culture, however. All beds made up during the months of May to July, inclusive, must, therefore, be built out of doors, or in very cool cellars. Not because they will not succeed in bearing crops, but owing to the fact that all produce formed in enclosed and covered structures during the summer months is so infested with maggots internally as to be absolutely useless. Practice may probably discover a remedy for this drawback, but until such time as it does, all attempts at such culture must be abandoned.

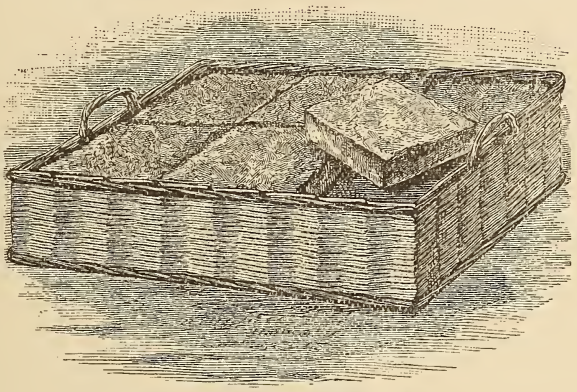


Fig. 2.—Cakes of Mushroom Spawn.

Beds formed, however, out of doors in the above months prove most successful, giving abundance of very meritorious produce. It is well to bear certain facts in mind when selecting a site for summer beds. The situation should have for its base a certain amount of natural dryness, and be one not likely to be subject to the inflow of water, as the result of heavy rains. Some back corner beyond observation, under trees having moderate heads of foliage to save too much drip from heavy rains, would be suitable, though it will be well to have it contiguous to the water-supply. An empty pit, not required for other uses, would suffice, and the under-stage floor of a glass structure would suit during the winter months.

Having sufficiently explained what are the most convenient places adapted to the formation of Mushroom beds, we return to the materials prepared and ready for use.

In-door beds, which may be made between the months of August and May, should not be less than one foot in depth of material. To insure this it is best to place a board or boards, attached to firm uprights, one foot or fourteen inches in depth, on all outer sides, where any bed does not rest against a wall or partition.

This is essential, from the fact that the materials require to be of an equal depth throughout of one foot, and must be trodden and beaten down as firmly and evenly as possible.

Along with the materials previously prepared a quantity of stiff fibrous yellow loam should also be secured. Place a layer of straw over the floor first, and upon it another layer of the coarsest, or straw-litter portion, of the materials prepared, and again cover these over with a layer of the material in bulk. These layers will raise the space allotted to the bed up to about one-half its height. Sprinkle next over this mass a thin layer of the loam, so that it falls in between the material and partly covers it over. Add another layer of material, then just another sprinkling of loam, continuing thus until the space within the boards has a heap of loose materials within it, which rises some six inches higher than what is to be the height of the bed when well beaten down. Thrust a thin long stick to its base in the centre of this heap for a test of the action of heat within it, and let the whole remain for two or three days.

After the lapse of this time the materials should be again slightly fermenting, and a nice warmth should prevail within them, which will communicate itself to the test-stick, by the withdrawal of which its extent can be ascertained. Should the heat be great, as is occasionally the case when the materials are damp, the bed must remain for another day or two, for it to moderate. Then tread down evenly and firmly, and with beater or rammer make the whole as uniformly firm as possible. The test-stick must be again inserted, and a day or two allowed to pass before more is done. After which, if the internal heat of the bed does not exceed 70° it may be spawned.

In the event of the heat exceeding this, more time must elapse before spawning. On the other hand,

should the materials not ferment after being rammed down, spawning must be done immediately, and the bed be covered with about six inches of hay; such hay to be well beaten over first to separate the seeds from it and to make it more pliable, so that it lies closely upon the bed and together.

The process of spawning is very simple. Cakes of Mushroom spawn are purchasable from all nurseries and seedsmen by the cake or bushel. One cake will be ample for a bed one yard square. With a very blunt dibble make a hole in the surface of the well-beaten bed, about one inch deep, break a cake of spawn into eight or ten pieces, and insert a piece into the hole, drawing the material around and over it tightly so that it is just covered over. The whole bed must be dotted over with such pieces at equal distances apart. Though it may not be possible to say how far any one piece will extend ultimately, it is well to intimate that the thicker the spawn is placed the better, as there will then be far greater certainty of an early and good crop.

When the bed is very warm or likely to fluctuate, beat the surface over with the back of a spade to make the mass of the bed as firm as possible again, after spawning, and leave it thus for a day or two. Should it not be too warm or likely to fluctuate, place a layer of one to two inches in thickness of the yellow loam, previously referred to, evenly over its surface. Carefully remove all stones and rough portions, and beat it down firmly and quite evenly throughout, even to the very corners. Now procure tepid water, with a water-pot having a fine-rosed nozzle, and a pail with water also. Sprinkle the bed over so that this loam becomes evenly moistened over its whole surface, and again pat it down with the bright back of the spade, dropping a little more water meantime to give it greater plasticity, or to make it like mud. This secured, dip the blade of the spade into the pail of water and work the surface over, so drawing it backwards as to leave a smooth plastered-in appearance. By this means the whole mass will, when dried, cohere together, which insures just that particular wholeness or consistency wherein the tubercles or Mushrooms form best upon the singular white thread-like mycelium, called in the aggregate spawn. It only remains now to place a nice covering over the bed of the hay, slightly damped, prepared as before suggested. Any other bed which may be too warm for soiling at the time of spawning, must be treated in like manner as soon as the heat wanes. And the proper heat for spawn to grow in may be marked as being between 58° and 75°.

After the bed has been soiled, and covered with hay, it will need no further attention for about one month. In the meantime, during winter, the artificial heat within structures may range between 60° and 75°, and all beds made out of doors must be duly protected from excessive rains and the too great heat of the sun, the latter being secured by additional coverings of hay, straw, or other similar litter.

More rapid progress is made by dipping the spawn bricks into a pail of luke-warm water for about twenty minutes before the cakes are broken to pieces for use.

Though we have given the best, quickest, and safest method to grow good crops of this excellent comestible, we have not by any means exhausted the subject, or methods which might otherwise be employed to secure good crops. It is not always convenient for amateurs to use crude horse-droppings and stable sweepings only. In cases where this cannot be done, collect a heap of horse-droppings or those of sheep and deer, along with a little somewhat dried cow-dung. Add to this heap about an equal part of decayed manure from an old cucumber-frame, or any decomposed sweet vegetable manure. Turn it well up together, intermixing all the parts most thoroughly. Make a bed with these, in all respects similar to that suggested above, in-doors or out of doors, according to the time of year, treating it similarly in the matter of spawning, &c., and a crop may be expected.

Mushrooms may also, in the majority of instances, be grown without the aid of artificial spawn, as follows:—Prepare stable manure and sweepings as for the bed originally given above. Place a layer of straw at the bottom of the bed, then a layer, about two inches in thickness, of the stable manure, then a layer of one inch of such loam as recommended above. Upon it put another layer of loam, finishing off with another layer, as aforesaid, of stable manure. Make very firm and place surface soil as before. This bed, though longer coming into bearing, will after a month or two produce a good crop.

It is necessary to refer to one consideration in connection with the materials. Observation, present and past, seems to affirm the fact that horses fed upon dry food—corn, &c.—afford the best materials for this purpose. Horses and cows, on the other hand, whose diet is grass alone, afford little or no assistance to the growth of these fungi. We suggest, therefore, that such be always avoided.

The treatment of the beds after cropping has commenced, or after spawning, is an important consideration, both as regards the merit of the immediate produce and its future continuance.

Semi-dryness Essential to the Growth of Spawn.—Mushroom spawn refuses to grow in a wet medium; indeed an excess of latent moisture exist-

ing in any matter within measurable distance of it checks, if it does not destroy it; for this reason the materials must be moderately dry, and for this reason also the bed must be kept dry for a period of five or six weeks after spawning, and during such time as the spreading of the spawn fibres in process of growth takes place. It is owing to want of better knowledge in this respect concerning the earlier stages of progress of those underground fibres, that so many fail in attempts at growing this crop; the belief being that moisture is the very existence or life of this strange production, an inference obtained, no doubt, from the thought that during damp, showery autumns the indigenous crop is most abundant. The fact is overlooked that invariably a dry spring or early summer period, giving birth and life to these underground ramifications, preceded such an one of dampness. Generally after beds have been spawned and soiled about five or six weeks the minute buttons begin to appear. Then is the time to commence slightly sprinkling, or syringing, the surface of the bed, to be continued and increased as the crop matures, until in about six or eight days such a main watering may be given as will find its way throughout, down to the very bottom of the bed. In connection with such watering, should the bed be one heated in-doors during winter, a nice warmth should be generated throughout in the heating media and the house or shed. The water used should be slightly warmed for the purpose. In like manner when out-door beds are watered it is best done upon a warm sunny day. From this time forward the bed must be frequently moistened upon its surface, and receive such an amount of water within generally, as will insure to it a nice amount of internal moisture, which can be secured without much risk if a good site has been chosen and the drainage, consisting of rough materials at the bottom, is perfect. After beds have been "in crop" about one month, or at such time as the supply of produce decreases, give a watering with moderately strong liquid manure, adding about an ounce of common salt to each gallon of water.

Scientific research has all but demonstrated the fact that the surface growth, or the Mushroom itself, is an immense absorbent of food for its own growth and support, as witness, even during long dry periods in early autumn, what a free growth field Mushrooms make during nights when excessive dews prevail. This shows that very frequent surface sprinklings are more to be desired than much water below the surface. By the practice of the former, beds will not only be more productive throughout, but will continue far longer in bearing.

It is injurious to the future crop to permit the produce to become old before cutting, as the spores then ripen, and place a far greater tax upon the base. As far as possible, gather the crop by twisting off each single Mushroom. Where clusters grow together, however, they must be neatly cut off. The old base should be removed immediately it shows symptoms of decay, or it will communicate such to the other active portion below ground.

We have treated thus far of definite methods by which Mushrooms can be produced. By the employment of similar practices, in connection with such materials as we have named, there is, however, hardly any limit to the variety of ways they may be grown—as, for instance, in boxes, baskets, pots, &c., of any size. Many excellent crops are secured by simply inserting pieces of spawn into the sides, &c., of cucumber-beds; and, indeed, they have been induced to grow by inserting artificial spawn into pasture-land early in the month of May.

British growers are very much behindhand in regard to Mushroom culture. In France it has been reared into quite a distinct industry, so much so that it is estimated more than twenty tons are grown and sold daily in and around Paris, where caves and subterranean quarries are set apart for the purpose, those of Montrouge in particular.

The horse-manure of Paris is valued accordingly, bought up and contracted for year by year; so unlike that of our own metropolis, where the General Omnibus and other companies can hardly induce agriculturists to cart such away and keep their overfilled yards empty.

Mushrooms sell at from 8d. to 9d. per pound in Paris, in the quantities named. In England, any kind of punnet is charged at from 1s. upwards. Worse than this, 95 per cent. of British-bought Mushrooms consist of the coarsest variety, indigenous to our fields and woodlands, known in rustic lore as the "Horse" (*i.e.*, coarse) Mushroom.

The chief enemies of the Mushroom are mice, slugs, woodlice, beetles, and flies. Woodlice are destroyed by being attracted to a dry corner and made short work of with boiling water. Fresh-slaked lime placed in water, used in moderate quantities, will lessen the fly plague. The other pests are destroyed in many ways, which need not be explained here.

The produce of some beds is attacked by a parasitical disease, consisting of a fibre-like fungus, which overruns the beds and envelops the crop in such manner that the produce is deformed, the very fibres being enlarged, flattened, or contorted. The only remedy appears to be the removal of the bed infected, a thorough cleansing of the site, and the procuring of entirely new spawn.

Mushroom spawn is an object of interest, though in its superficial aspect simple and easily under-

stood. Its underground thread-like fibres, the mycelium, have an immense capacity for propagation and extension, so much so, that in congenial surroundings every particle of it is capable of extension and extended growth. The spawn must however, to do this, be maiden spawn, or such as has not "fruited," or actually produced Mushrooms. It requires a dry place wherein to grow, and so particular is it in regard to this, that the spawn of Mushrooms and of many other fungi has a peculiar power of keeping off rain and moisture. There is no more certain method of destroying some troublesome growths of the kind than by immersing them in water. To this characteristic may be added another, that it matters not how long purchased cakes of spawn be kept, providing they are stored in a warm and dry place, even if over an oven or flue, though not too close to it.

To obtain an increase of spawn, stable sweepings with other manures mixed with loam are moistened so that they can be made into "bricks" or cakes. They are then placed to dry. When moderately dry a small place is cut or scooped out of the centre of each. A small portion of an old cake is inserted into the cavity formed. The cavities of two cakes are then placed opposite each other, the sides of each two meeting. The many cakes when done are placed in one heap, closely packed and fitting together, and either by aid of well-seasoned fermenting material, a flue, or otherwise, a nice dry warmth is maintained throughout this mass, the result being that the spawn permeates the whole. Immediately this is seen the cakes are separated and dried. Thus is maiden spawn held in suspension, as it were, until such time as it is again set to work growing, and given the natural power to produce vegetation in kind. In a word, one leaven, an old spawn brick or cake, leavens the whole; the leaven being still held in bondage until, like German yeast, it is needed for the main purpose.

As showing how amenable to the proper stimulus it is, let a box be filled with straw to the depth of an inch, firmly at the bottom, then break a cake of spawn into pieces and lay evenly and firmly upon the straw, and cover with three or four inches of loamy soil, ramming all down quite hard. Keep in a warm place for five or six weeks, sprinkling the surface as frequently as it becomes dry, and the spawn will grow, and Mushrooms be produced.

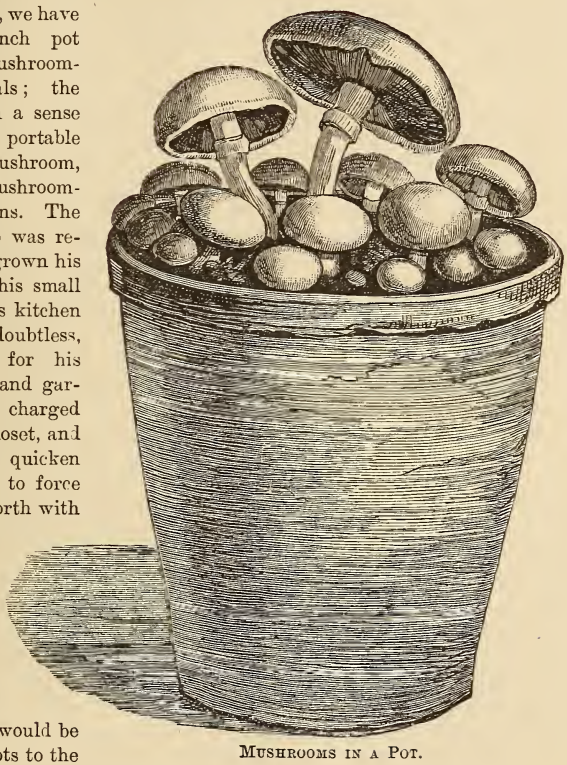
It is imagined that a darkened place, and more or less airless, is needed in connection with the artificial culture of Mushrooms. An idea so opposed to nature's plan is an error. A covering of hay, as advised, is useful in preserving an uniformly moist surface; but, so far as can be observed, the Mushroom is one of those few vegetable products to which the darkness and the light are both alike.

PORTABLE CULTURE OF THE MUSHROOM.

By D. T. Fish.

The Mushroom, though as a rule cultivated in beds, out of doors and in, as already described, can also readily be grown in pots, pans, baskets, as well as in stables, cow-houses, common garden frames, green-houses, cellars, garrets, kitchens or other living-rooms, and outhouses. The details of culture in these cases vary, but the general principles that underlie it are the same as those already laid down. There is, however, this important difference at starting, that as the area occupied in portable and what may be called makeshift Mushroom culture is mostly very limited, only the very best materials should be used. These are, in brief, horse-droppings, not only from corn-fed horses, but, as far as possible, from the purest and highest-bred animals; for it has almost passed into an axiom in Mushroom culture, that the higher the breed, as well as the harder the food of the horse, the better the spawn runs in it, and the finer and more plentiful the Mushrooms produced. Hence the droppings of carriage and riding horses are far preferable to those of cart or team horses; those of hunters better than of carriage horses, and those of race-horses best of all. Therefore, if the latter are procurable, provide such for the pot-culture of the Mushroom, and see to it that they have neither been injured by wet, nor weakened by any admixture of stable sweepings whatever. As the droppings can hardly overheat within the narrow limits of a six or eight-inch pot, if they are sufficiently dry they need no sweetening or preparation whatever, but may be rammed firmly into the pots so soon as received. Pots for Mushrooms should be drained with a few potsherds, as already described for pots in general; or if that is not available, a little rough and very dry cow-dung may be used in lieu of crocks. A piece of spawn the size of a bantam's egg may be placed in the centre of the pot, within two inches or an inch and a half of the rim. This will be sufficient for a six-inch pot. Should eight-inch or larger pots or pans be used, four pieces may be placed in each pot, one in the middle, and the three to form a triangle round it. Cover over with the droppings, ramming them in as firmly as possible, and surface with a mass of good loam, leaving the surface as hard and smooth as may be, thus beginning and completing the miniature Mushroom-bed at one operation. But lest any reader should be discouraged from trying the pot-culture of Mushrooms because he cannot procure the droppings of thoroughbred

horses, it may be stated at once that any manure or compound of sweepings or rubbish that will grow good Mushrooms in beds, will grow them in pots, boxes, baskets, or other portable contrivances. But with weaker and inferior material to start with, it can hardly be expected that so many nor so fine Mushrooms will be gathered from a given area. Whatever sort of material be used, the mode of procedure, and the necessity of firmness and solidity, will be very much the same. Here, then, we have say an eight-inch pot charged with Mushroom-growing materials; the next step, and in a sense the first, in the portable culture of the Mushroom, is to place it in Mushroom-growing conditions. The French cook who was reported to have grown his buttons, that is, his small Mushrooms, in his kitchen drawer, would doubtless, in his anxiety for his favourite flavour and garnish, whip the charged pot into his hot closet, and so warm up and quicken the mycelium, as to force the Mushrooms forth with a rush. Well, if he did not exceed a temperature of 75° probably no harm would be done, and much time saved. But the best way would be to plunge these pots to the rim in a bed of fermenting manure, at a temperature of 70° or so, till the spawn had covered the surface of the soil with white threads; these should be rubbed off as they give the surface a white appearance, as otherwise the strength of the spawn will run to threads, not to Mushrooms. The pots may continue in a temperature of 65° till small Mushrooms form, and can then be removed into a sitting-room or other window, so that their growth may be watched. As the ordinary living-room is mostly too dry for the well-doing of Mushrooms, it is a good plan to cover them with a bell-glass or cloche, to keep up a moist atmosphere for the Mushrooms. The trouble is not greater than in the case of Ferns grown under similar conditions. The interest of watching the development of the pure white fungus is equally great, and the produce is assuredly more useful.



Mushrooms in a Pot.

But such troublesome expedients are only needed in what may be called the parlour-window culture of the Mushroom. If content to reap the sweet produce only, without having the additional pleasure of seeing it growing, the Mushroom pots, boxes, or pans may be set anywhere, in the dark, on a shelf, or on the floor, and they will need but little attention till the produce is fit to gather. They may also be grown in rooms with safety, with the surface covered with green moss, and it is one of the most pleasing sights in horticultural pursuits to see the rising cluster of Mushrooms in the centre of the pot first upheave, and finally throw off their coverlet of moss, and stand out in all their freshness and purity. Besides, the Mushroom pot or pan may stand in a warm room or shelf from the first, without any harm, if the surface is covered either with moss or cocoa-nut fibre refuse; or they might even be planted with some of the more dwarf Club Mosses or Lycopodiums, such as the golden or silver varieties of *Selaginella denticulata*. But apart from the fancy and ornamental portable culture of the Mushroom, it may readily be made as profitable as any other method, and it brings a supply of this much-coveted luxury, good fresh Mushrooms, within reach of all classes and conditions of men; while even those who have means of cultivating Mushrooms in permanent beds out of doors, or real Mushroom houses, might often supplement these by hurrying a few Mushrooms in more quickly, and to fill up or prevent those awkward gaps that are so apt to occur between the exhaustion of one series of beds and the incoming of another. In the portable culture of the Mushroom for utility, far larger pots, pans, and boxes or baskets are used. Old packing or grocer's boxes of any kind, especially the stronger

and deeper ones, and the round baskets received from nurserymen with plants, are admirably adapted for the wholesale growth of Mushrooms on the portable method. When these are over a foot deep, it would not be necessary to quite fill them with materials, and the precautions of watering and testing for fear of over-heating, referred to in the preceding general article on Mushroom culture, would have to be observed. Hence it would not do to fill spawn and soil at once, as for Mushroom culture in small pots.

But supposing a hamper, a yard or more in diameter, thus filled with Mushroom-growing materials, room could generally be found for it in an empty stable, or corner of a stable, cow-house, or bullock-shed; and it would be impossible for art to provide a better or more genial atmosphere for the rapid growth of Mushrooms than that produced without cost in such places by the insensible perspiration and breathing of the animals. Another capital plan for growing one or more boxes or baskets of Mushrooms would be, on a few basketfuls of fermenting materials in the corner of any outhouse or cart-shed, with a covering of the same or of hay thrown over the surface. Neat clean boxes could also be placed in store-rooms, beer, coal, or wine cellars, in the larder or kitchen, or any spare room or corner. Properly prepared, the boxes or baskets would need no water till the Mushrooms began to come, and probably little or none afterwards. If the surface got dry, a mere dewing over with a fine-rosed watering-pot would suffice; and if more water became needful as the crops grew, it would not be very difficult to remove the pots, pans, boxes, and baskets, give them a liberal watering with water at a temperature of 80° at the least, cover over from the air, leave them an hour or so to drip, and return from whence they came. If Mushroom material in small pots gets dried up, the simplest manner of watering such sufficiently is a dip overhead in water of the above temperature. But this is seldom needful unless they are placed in very dry positions. The results of watering Mushroom-beds in bearing, whether large or small, are so problematical, and the judgment needful to perform this crucial operation so great, that, as a rule, the amateur grower will do far better by gathering all the beds will yield without watering, then removing them, and starting anew with fresh material, instead of striving, often in vain, to resuscitate the productive force of semi-exhausted beds by attempts to water them again into new life and more produce.

Yet watering properly understood and skilfully practised is often most useful. The two worst difficulties in the way of the successful culture of Mushrooms, are an excess of moisture and a low temperature at the same time. Now, supposing a pot, box, or basket of Mushrooms to be over-watered, nothing can be easier than to whip them up, place them in or over a dunghill for a time, or in a hot closet or warm shelf in kitchen or store-room, or over the manger in stable or cow-house, until the evil effects of excessive moisture are neutralised by the prompt application of extra caloric.

Again, supposing a pot, box, or basket of Mushrooms fail, the loss is but trifling, and others may soon be pushed forward to fill the gap. But should a large bed get out of order, there is the loss of months, and also of a large amount of produce.

But the great advantage of this system is that it brings Mushroom culture within reach of all. The poorest cottager may pick up an old box at his grocer's for twopence, and sufficient amount of droppings may be gathered off the road at his very door, and for another penny the nearest nurseryman will furnish him with a bit of spawn; a spadeful or two of new soil, or of common garden earth, will suffice to cover it; it may be propped up over the sleeping place of his pig, and anon he will gather several shillingsworth of Mushrooms, either to add to his slender income, or provide a few most nutritive meals for himself and family. The artisan and amateur will find a new pleasure in the culture of the Mushroom on these portable plans.

Those, too, with small gardens, may place bits of spawn among their growing crops in the kitchen garden, bury some horse-droppings, with a morsel of spawn in their centre, in their grass lawns, and place pieces wrapped round with prepared dung under cloches and bell-glasses, and in cucumber and melon frames towards autumn-tide as these crops decline, and under the stages and shelves of their green-houses and conservatories; and so after due time find Mushrooms springing up, alike to their profit and pleasure, in the most out-of-the-way places.

Mushroom-growing is indeed one of those pursuits that those in crowded towns may follow as successfully as the more favoured horticulturist in the country. The best of horse-droppings abound in towns. Boxes of all kinds are also plentiful, and a few of these properly filled could even be placed on areas, balconies, and housetops. Carefully covered over, and protected from extremes of drought and of cold, the spawn would run as freely and as strongly among surrounding soot, dust, and dirt, as in the purest air of the country. The portable Mushroom-beds, canopied with cocoa-fibre, tissue, moss, or, if preferred, an old flannel petticoat, will feel none of the untoward influences around them, and are, when they push through, smoothly covered with an anti-adhesive skin, that the blacks will

glide as harmlessly off from as water from a duck's back. Besides, they need never be exposed to the light at all, as there is no perceptible difference either in substance or flavour between Mushrooms grown in the dark and in the light. To the Mushroom, in fact, as has already been observed, the darkness and the light are both alike. Even the very poor, who live alike in the blinding glare of the garret and the stifling gloom of the cellar, and who in both mostly manage to keep some flowering plants alive in some broken jar or cracked tea-pot, may have some of the pleasure and profits of Mushroom-growing brought within their reach. The portable culture of the Mushroom will prove easy to those who have done so much and so well with other plants, under difficulties that seem as appalling as insurmountable.

FLORISTS' FLOWERS.

By Richard Dean.

CALCEOLARIAS AND CHRYSANTHEMUMS.

The Calceolaria.—There are three distinct types of Calceolarias known to florists, viz.—the Herbaceous, the Shrubby, and the Bedding. The first-named of these is represented by the pretty green-house varieties of the present day, so much seen during the months of May, June, and July, in gardens and in the flower markets. The Shrubby Calceolarias have almost ceased to be grown by plant cultivators; they are a section intermediate between the Herbaceous and the Bedding varieties, and good plants of the type can be occasionally met with in the windows of cottages in country districts; the Bedding varieties are of hardy growth, and are much used in flower gardens during the summer, though not so much as they formerly were. The Calceolaria has the common name of Slipperwort, and the generic name, Calceolaria, was bestowed by Linnæus from *calceolus*, a slipper, in allusion to the form of the flower.

It is recorded that in 1820 only six species of the Calceolaria were known in this country, the handsomest of which was *C. corymbosa*, the flowers of which were yellow. These were probably natives of Peru. During the subsequent period, up to 1830, several other kinds were introduced from Chili, two of which had purple flowers, viz., *C. purpurea* and *C. arachnoidea*. As soon as the plants bloomed in the nursery of Messrs. Youngs, of Epsom, it struck Mr. Penny, the foreman, that it would be advisable to hybridise them. The attempt succeeded beyond expectation, and the result was, a number of beautiful varieties were produced and offered to the public under appropriate names. In 1831, *C. crenatiflora*, having yellow flowers spotted with dark, was introduced from Chili, and from this some finely-marked varieties were raised. These productions fired others with a desire to improve this flower, and it was taken in hand by several cultivators, all of whom were highly successful. Such names as Plant, Major, Barnes, Green, Kinghorn, Gaines, Catleugh, and others occur to us; and later in point of time, Mr. James, formerly of Isleworth, did much to develop the really magnificent flowers we are accustomed to see in the present day. Concurrently with the improvement of the flowers came the dwarfing and rendering more compact and bushy the habit of growth of the Calceolaria, as formerly it was quite tall and lanky. We fear that now-a-days raisers look too much to the mere size of the flowers, and too little to their form. A model plant of Calceolaria should have a vigorous free-branching, yet compact and healthy, habit of growth; the flower-stems strong and erect; the flowers large and globular, of regular outline, and clear of indentation, the marking decided, and striking in colour. Such a plant is seen in the illustration accompanying this article.

Notwithstanding that the Herbaceous Calceolaria is considered by some to be difficult of culture, we assert that this is a fallacy, for with due care and attention there is scarcely another florist's flower more easily managed; and it is not an unusual sight, as stated above, to see this plant in a country cottage window, luxuriant in growth, freely flowered, and in the best condition. Here are a few golden rules for growing the Calceolaria successfully:—Keep the plants tolerably dry in winter, well protected from frost, with as little fire-heat as possible; and during the summer months supply them liberally with water. Keep them well shaded from the sun, and at all stages of the growth of the plants maintain the foliage clean and entirely free from insects.

Time was when fine varieties of the Calceolaria were increased by offsets and cuttings taken in September. Then it was much more difficult to grow a good specimen than it is in these days, when dependence is placed entirely upon seedling plants; but our forefathers used to produce splendid specimens at flower-shows notwithstanding, raised from cuttings, that were the admiration of all who saw them.

In these days the method of culture is simpler, more rapid in development, and when done with care, equally at least, if not more satisfactory. The successful culture of many plants depends, to a great extent, upon little attentions constantly paid them, and the Calceolaria is a case in point. The seed may be sown in May, June, and July; and a light, rich, sandy soil must be employed. If pans or pots are

used, they should be half or nearly half filled with pieces of pots—crocks, as they are termed—broken small, to give drainage; over these should be placed some rough soil, and then filled to the surface with fine soil, pressed down until a level smooth surface is secured. Now the seed of the Calceolaria is very small indeed, and so a mere pinch suffices for a sowing; this should be spread over the surface as thinly as possible, and when this is done, covered with a very slight sprinkling of silver sand. The pots or pans can then be placed on a shady shelf in a greenhouse, or for the matter of that in a cold pit, and if a piece of glass is placed over each, and the tiny seeds shaded from the sun, the surface will be kept cool and moist, and germination greatly assisted. As soon as the tiny plants appear above the soil, which will be in a short space of time, a little air should be given, and the plants encouraged to grow as strong as possible. But they should not be allowed to become very wet nor very dry. As soon as large enough to handle it is best to prick them off thinly into other well-drained pots of fine soil, as this not only encourages the transplanted plants to grow on into size, but it gives more room for the remainder to develop. As soon as any of them are large enough, they should be potted singly into small pots, placed in a cold frame, shaded from the sun, kept moist and growing, have plenty of air, and be shifted into larger pots as required. No shifts should be given between November and February, as during mid-winter they do not make roots, and the plants winter best when the roots touch the sides of the pots in which they are growing. The best place for the plants during the winter is a frame heated with hot water in case of severe frosts or very damp weather; but failing this, they will winter in an ordinary green-house if not kept too close in mild weather; and should it be unusually mild, the plants might be safely wintered in a cold frame; but the great thing is to guard against injury from damp. Some of the most successful cultivators of the Calceolaria keep their plants during mid-winter in a temperature not higher than 50°, and not lower than 35°, they are kept as much as possible from harm through damp, and every precaution is taken to keep them free from the ravages of green-fly. In order to do this, they fumigate the plants with tobacco-smoke once a fortnight; but others manage to keep the fly at a distance by means of less frequent smokings, and even with none at all. It is on the under sides of the thick downy leaves that the insects gather, and if there are no fumigations the under sides of the leaves should be examined at times, and any insects brushed away by using an artist's brush. If only a good, free, healthy growth can be secured, a satisfactory head of bloom will be certain to follow. But from first to last this healthy development of foliage will depend, to a large extent, on giving air freely, but not when cold frosty winds are blowing, and especially so when there is a danger of their blowing directly on the plants. Should frosts come on suddenly in the night and affect the plants, they should be covered up for a day or two, and kept quite close and dark; the result will be that when uncovered and exposed to the light they will be found to have taken very little harm indeed. But it is best not to subject them to frost if it can be avoided.

But little training is necessary in the case of well-grown plants of Calceolarias. When the flower-stems appear, a few slight stakes may be necessary to keep them erect and neatly displayed; and no further shifts should be given after the flower-stems have begun to develop. But the pots will be full of roots, and the plants must be kept well watered, and a little weak manure-water may be given once or twice a week with great advantage. But as it is quite out of the power of some amateurs to provide themselves with liquid manure, we can confidently recommend the use instead of "Clay's Fertilizer," a patent manure of great value, which is sold in small quantities in canisters. All that is required is that a little of the manure be sprinkled over the surface of the soil, and washed into it when water is applied.

It is when the amateur gardener places his Calceolarias in his house of mixed plants that they frequently show decided and rapid signs of deterioration. They will not stand exposure to hot sunshine as well as Pelargoniums, Fuchsias, and other things of similar character. These can be occasionally syringed overhead with water without doing much harm to the flowers, and if they become a little disfigured, others are soon produced to take their place. It is not so with the Calceolaria; for its blossoms are produced at one effort and not successionally, and if water is allowed to rest upon the flowers they soon rot. The pots being full of roots, the soil soon dries, unless they are very closely looked after, and no other plant displays the deteriorating effect of drought at the roots as does the Calceolaria. It is much the best to grow the plants in a house by themselves, the roof of which can be shaded in some way, and when this can be done Calceolarias are not only much more effective, but more lasting also. If kept cool, and moist at the roots, the plants remain in full beauty for a long time, provided the decaying flowers be picked off as soon as they fade.

The cultivator should be careful to save a little seed from the very best varieties, and sow it as directed as soon as ripe, if he can obtain it, by the month of July. But he should not save merely

from the largest flowers, but from such as are finely marked, of good size, and symmetrical in form, combined with a good habit of growth. If his strain happens to be of indifferent quality, he should obtain seed of a good one from some reliable seedsman. No list of varieties can be given, because the practice of naming fine varieties is no longer followed.

Regarding the Shrubby Calceolarias, a few varieties of which can still be obtained, it may be remarked that they very seldom furnish seeds, and have to be propagated by means of cuttings. Growing young shoots strike freely towards the end of the summer, when the sun's heat is on the decline. The cuttings can be put in pots of sandy soil, and placed in a cold frame, and when they are struck they require to be potted off singly into pots, returned to the frame, and as soon as the young plants are established, the shoots should be stopped, *i.e.*, pinched back; the result is that they break out into lateral growths, and by tying out these shoots, fine specimen plants are secured. The principal growth of the plants will be made after Christmas. The general treatment is the same as that recommended for the Herbaceous Calceolarias, but they will bear a greater amount of exposure, being of more robust constitution.

CALCEOLARIAS.

The following varieties are now cultivated :—

Golden Gem.	Sparkler.
General Havelock.	Burbidgei
Invincible.	Victoria.

The Bedding Calceolarias are treated of under the head of "Bedding Plants."

The Chrysanthemum.—This name is derived from *chrysos*, gold, and *anthos*, a flower. The

Chrysanthemum is the favourite autumn flower of this country; it is nearly as popular as the Rose, and like the Rose, it can be grown and enjoyed without the employment of glass structures, though these are of great service in prolonging the beauty of the flowers, that would otherwise be marred, if not altogether spoiled, by the rains and frosts of autumn. Indeed, such improvements have been made in the Chrysanthemum of late, that we have now very early-flowering and very late-flowering varieties, and now large quantities of blooms of Chrysanthemums are had under glass as late as the months of January and February.

The remarkable large-flowered varieties of the Chrysanthemum at present in cultivation have been obtained from *C. sinense*, a native of China. *C. sinense* was introduced to the gardens of Europe about 1764, and, as far as can be ascertained, the flowers of the first introduction were rosy-purple in colour. It has been greatly improved by the English and Continental florists, and at the present day there are in cultivation varieties so fine that it seems difficult to imagine they can be materially improved. The pretty Pompon varieties, with their small neat flowers produced in such plenty, were obtained from the Chusan Daisy, sent home by the late Mr. Robert Fortune, from China, in 1846. The Continental florists were foremost in improving this interesting little flower; and from its being single, and like a common Daisy in appearance, it has been improved so successfully, that the flowers have become fully double and singularly handsome. The Continental florists have always enjoyed one great advantage over their brethren in England—that their climate is much more favourable to the production and ripening of seed than is our own. The late Mr. John Salter, who raised many very fine large-flowering Chrysanthemums from seed, used to *send* plants to the South of France in order to insure a supply of seed. The singular and fantastic Japanese Chrysanthemums were also obtained from plants sent home from Japanese gardens by Mr. Fortune some twenty years or so ago, since then the varieties have increased with wonderful rapidity, and of all shapes and colours. Their grotesque flowers are very striking. Formerly they used to flower later than the ordinary large-flowered Chrysanthemums, but now many early-flowering varieties have been introduced, and they can be had in flower now for something like six months in the year; while they are largely grown for exhibition purposes.

We are now dealing with the culture of the Chrysanthemum in pots, and as this system is at present generally followed it may be regarded as the popular mode of growing this plant. Those who grow Chrysanthemums for their flowers alone, aim at cultivating good specimens, and it is our purpose to set forth how this can best be done. To commence, it is important that, in the choice of varieties for specimens, great care should be taken to select only those varieties possessing the following qualities, viz., free blooming, clear and distinct colours, fine foliage, and graceful habit. There are now so many varieties possessing these characteristics, that no difficulty need be experienced in obtaining them.

Specimen plants should be raised every year from cuttings or suckers, but it is only in the case of a few varieties that are shy in producing cutting-wood that it is necessary to resort to suckers. And, as there is nothing like a good start, cuttings should be inserted in autumn or winter, as soon as they can be procured. Young wood from which cuttings can be obtained is thrown out from the base of the main stem of the plants in autumn and spring. Suckers are growths sent up through the soil from the roots. If a bed of light sandy soil be made up in a cold frame, cuttings will soon strike root in it; or if put into pots, singly or otherwise; or if it be required that they root quickly, in a gentle hot-bed. As soon as the cuttings are rooted they should be potted into small pots and grown into size, but taking care that the plants do not become drawn, and so spindly and thin, wanting in robustness. As soon as the plants are well established in three or four-inch pots, and have made three or four sets of leaves, the points should be pinched out; this is what is known as "stopping." This does not prevent the plant from lengthening, and it also encourages the growth of lateral shoots, five or six of these being necessary to form a good specimen. These, as they increase in length, should be pegged or tied down to the pots so as to form a good bottom or framework, and the plants need to be shifted into larger pots as required; and there should be no check either for want of root-room, or moisture at the roots. About the last week in June the plants should be shifted into their blooming-pots, and for larger specimens these should be fully eleven inches in diameter. It need, perhaps, scarcely be stated that robust-growing Chrysanthemums require larger pots than do spare-growing varieties, and as the plants increase in size previous to being placed in their blooming-pots, the soil should be made richer. In the earlier stages of growth it is customary to use a compost made up of sweet loam or rotten turf one part, leaf-mould one part, and clean coarse sand one part. Later on, the compost should be enriched by using rotten dung in the place of leaf-mould, and it is of advantage to put a pound of bone-dust to every bushel of soil. Some lime rubbish—that is, old mortar from buildings,

broken up small and the dust sifted from it—is useful as tending to make the soil porous and keeping it sweet. Failing this, coarse river sand or silver sand can be employed.

When the plants are finally placed in the flowering-pots, they should be stood out of doors in the open, fully exposed to the sun and air, and they do best when placed in lines with an opening between each. A bed of cinder-ashes makes the best bottom to stand the plants on, or they can be stood in shallow saucers of water; the latter plan has many advantages, as it prevents the roots from penetrating the soil, and saves watering, as no amount of water in the saucers will harm the roots, provided it be not raised above the level of the drainage in the pots. It also prevents worms from entering the pots. The best drainage for the pots is a good-sized oyster-shell at the bottom, then an inch of broken potsherds, and over this a layer of lime rubbish.

As most specimen plants require a centre stake to support them, this should be placed at the time of potting, and by fastening the main stem to this, the plants are kept from being blown about by the wind. During July and August strict attention must be paid to watering, and if a layer of soot be placed over the surface of the pots, and watered into the soil, it will greatly assist to keep the foliage in fine condition, and retain the leaves. Many amateur cultivators are frequently much concerned by reason of their plants losing their leaves—a condition common to the Chrysanthemums; and it is only by high cultivation, and constant attention to watering, that the foliage can be retained. Stopping must be done as required, but a plant should never be re-potted and stopped at the same time. It is very difficult indeed to lay down anything like general rules for stopping, as so much depends upon the variety. It is a matter depending a great deal on experience. During August the leading shoots require regulating, and the lower ones should be kept as near the pot as possible. About the middle of September the plants should be trained to the requisite shape by placing a stake to each leading shoot, leaving the stake longer than the shoot, as it continues to lengthen until it comes into flower. As soon as the flower-buds appear, some disbudding will be necessary. This is done by removing all buds except the one in the centre of each branch, for if the plant be vigorous, these will be quite enough to insure a fine head of bloom. But if a quantity of bloom is preferred to large flowers, little, if any, disbudding need be done. The plants should be housed about the middle of October, but much depends on the character of the weather. They are better outside so long as the weather is open and the buds do not show colour; the foliage also remains in better condition in the open air. When housed, fire-heat should be given only when absolutely necessary, but the plants should have as much air as possible. When the plants have gone out of flower, they should be placed on one side, but looked after in order to furnish young wood for cuttings.

It may be that some of our readers have a desire to grow a few cut blooms of Chrysanthemums for exhibition, seeing how many Chrysanthemum shows are held now-a-days. It is a very pleasant occupation, and a most agreeable recreation. Now, in order to have a few fine blooms, the late Mr. Samuel Broome, of the Middle Temple, recommended that cuttings be taken in the beginning of November from the suckers, or from the laterals of the flowering stems. These should be rooted in small pots, and placed in a cold frame for protection through the winter; shifted as soon as the roots are fairly formed into larger pots, say eight or ten inches in diameter, drained with potsherds or broken oyster-shells. Care should be taken not to allow the fibrous roots to rise round the pots too much before shifting, as this injures the plants, and thus progress will be materially retarded if they are not re-potted at the proper time; moreover, the fibres must be as little disarranged as possible in the operation.

In April and May a south aspect is desirable for the plants, but from the middle of June to the middle of August they should be removed to a shady spot, where they will only get the morning sun until eleven or twelve o'clock. Manure-water of a weak, cooling nature may be used in the former months, but its strength should be afterwards increased until the flower-bud begins to give indications of colour; in no case, however, should it be given until the plant has been soaked with clear water. When the crown of the plant divides itself, remove all lateral growths; and when the flower-buds are well grown, disbud or cut out all but the most shining, leaving but one to each stem. Should any of the blooms, on breaking, show an eye, it is a sign that the plant has been overdone with kindness. If the early blooms are too soon for any that may be later in flowering, and it is desirable to retain the former for exhibition purposes, they may be retarded for a week or nine days, and their back petals be preserved from decay, by gathering them into a ball and tying them up with some wadding, and then putting them into a bag made up like a sugar-paper. Another plan is to pass the bloom through a flower-pot, of which the bottom has been previously chipped out, and to cover it with a piece of glass. This has the effect of not only preserving the back petals, but of bringing the centre ones up to the light. In fact, it will make an incurved flower of a reflexed one.

There is such a thing as "dressing" flowers, in order that all incurved Chrysanthemums should be presented as even and regular in shape and size as possible. Such finely-shaped flowers as Mrs. Geo. Rundle do not require any dressing, but in others there may be some deformity of petal, or they may be a little irregular, and the tweezers soon make it right when used by a practised hand. It sometimes happens that more petals are produced than required, and they can be removed to prevent a little undue roughness in appearance. Nothing must be added to the flowers; but superfluous and injured or imperfect petals may be removed.

Pompon (Model of Perfection).
Incurved (Mrs. Geo. Rundle).
Japanese Incurved (Lord Beaconsfield).

CHRYSANTHEMUMS.

The Pompon or small-flowered Chrysanthemums are cultivated in much the same way as the large-flowered varieties, but it is not necessary that disbudding be carried on to the same extent. The Pompon varieties are often grown as standards, and

with great success, and the large-flowering varieties can be grown as standards also if only the proper varieties be selected. To form standards vigorous autumn cuttings or rooted suckers should be selected, potting them and shifting as required, and staking the plant to the height it is desired the plant should reach—about two feet six inches. After the plants have reached a little beyond the required height, they need to be stopped, and the grower should endeavour to get as many breaks as possible from the first stopping to form the head. All side shoots must be plucked off. A small framework of laths, erected under the head, is the handiest for training them on. Early-flowering varieties should be grown as standards, because they can be stopped a fortnight later than the others, which is necessary in order to obtain a good head.

Single (Mrs. Kellock). Pompon Fimbriated (Marabout). Japanese Reflexed (Mons. Ardene).

CHRYSANTHEMUMS.

The treatment of the Japanese varieties is similar

to that recommended for the large-flowering Chrysanthemums, modified in a few particulars by experience, and it also holds good of the large Anemone-flowered varieties.

The small Anemone-flowered varieties should be treated in the same way as the Pompon varieties.

There is a group of early-flowering Chrysanthemums which is being increased yearly, because they are found so useful. For pot-culture, these may be struck at almost any time, but cuttings raised between October and March as a rule give the finest blooms. Those struck in October mostly bloom in May and June; those in February and March bloom in July and August; and the plants should be stopped only once. For planting out in beds, where they are very serviceable, cuttings need not be struck until the end of February, and even up to the end of March, and they will all bloom well from July to September; and the semi-early varieties from September to the end of October, when the late varieties open their flowers. This is a very useful section indeed.

Also single varieties of the Chrysanthemum are taking a place among the cultivated kinds. They differ from the Anemone-flowered varieties in that, instead of having a disc of tubular florets, as in the case of the latter, they have a disc like that of the single Dahlia. They will no doubt be improved in size, and especially in colour, the last requisite being essentially necessary.

Green-fly is very apt to lodge in the centres of the young shoots of all Chrysanthemums. The best remedy is a little tobacco powder, carefully dusted over the affected parts. Mildew is best grappled with by dusting sulphur lightly over the leaves.

The following is a selection of large-flowered incurved Chrysanthemums:—

Alfred Salter.
Barbara.
Beverley.
Bronze Queen of England.
Emily Dale.
Empress of India.
Enamel.
George Glenny.
Golden Beverley.
Golden Empress of India.
Hero of Stoke Newington.
Jardin des Plantes.
Jeanne d'Arc.
John Salter.
Lady Hardinge.
Lord Alcester.
Lord Eversley.
Lord Wolseley.
Mr. Bunn.
Mr. Corbay.
Mrs. Dixon.
Mrs. George Rundle.
Mrs. Heale.
Mrs. Norman Davis.
Nil Desperandum.
Prince Alfred.
Prince of Wales.
Princess Beatrice.
Princess of Wales.
Princess Teck.
Queen of England.
Refulgence.
Sir Stafford Carey.
Venus.
White Globe.
White Venus.

The following are reflexed large-flowered Chrysanthemums:—

Amy Furze.
Annie Salter.
Chevalier Domage.
Christine and its varieties.
Cloth of Gold.
Cullingfordii.
Dr. Sharpe.
Felicity.
King of Crimsons.
Mr. Forsyth.
Phidias.
Violet Unique.

The following list of Japanese Chrysanthemums is especially recommended for exhibition purposes:—

Balmoreau.
Baronne de Prailly.
Belle Paule.
Boquet Fait.
Boule d'Or.
Carew Underwood.
Comte de Germiny.
Duchess of Albany.
Edwin Molyneux.
Elaine.
Fair Maid of Guernsey.
Fanny Boucharlot.
Grandiflora.
Hiver Fleuri.
Japonais.
J. Delaux.
L'Adorable.
Lady Trevor Laurence.
La Triomphante.
Mad. Clemence Audiguier.
Maiden's Blush.
Marguerite Marrouch.
Mdlle. Paule Dutour.
Mdlle. Lacroix.
Meg Merrilies.
Miss Stevens.
Mons. Ardene.
Mons. Astorg.
Mons. Garner.
Mons. J. H. Laing.
Mons. Tarin.
Mons. William Holmes.
Mr. H. Cannell.
Mrs. H. Cannell.
Ralph Brocklebank.
Thunberg.
Val d'Audorre.

The following are excellent decorative varieties of the Japanese section:—

Arlequin.
Beauté de Toulose.
Bertier Rendatler.
Blanche Neige.
Cœur Fidèle.
Constance.
Dr. Masters.
Etoile du Midi.
Fulton.
Hiver Fleuri.
Ile Japonaise.
James Salter.
La Charmeuse.
Lady Selborne.
Margot.
Martha Harding.
Mons. Brunet.
Peter the Great.
Red Dragon.
Sarina.
Soleil Levant.
Source d'Or.

A selection of Pompon Chrysanthemums:—

Adèle Prisette.
Antonious.
Aurore Boreale.
Bobs.
Cedo Nulli and its varieties.
Dick Turpin.
Elenore.
Fanny.
Golden Madame Marthe.
La Vogue.
Madame Montels.
Marabout.
Mdlle. Elise Dordan.
Mdlle. Martha.
Miss Wheeler.
Mr. Astie.
Mrs. Bateman.
Nellie Rainford.
President.
Prince of Orange.
Prince Victor.
Rose d'Amour.
Rosinante.
Souvenir de Jersey.
St. Michael.
St. Thais.

Early-flowering Chrysanthemums: Japanese varieties:—

Bouquet Estival.
Ete Fleuri.
Félicité.
Feu de Bengale.
G. Werring.
Isidore Feral.
Madame C. Desgrange.
Mandarin.
M. Pynaert van Geert.
Roi des Precoces.
Simon Delaux.

Early-flowering Pompon Chrysanthemums:—

Anastasio.
Curiosity.
Early Blush.
Frederic Marronet.
Hippolyte Jamain.
Le Petite Marie.
Madame Jolivart.
Madeline Davis.
Mr. W. Piercy.
Nanum.
Précocité.
Souvenir de M. Rampont.
St. Crouts.
St. Mary.

GARDEN WALKS AND ROADS.

LINES OF BEAUTY IN ROADS AND WALKS.

IN the olden times the shortest route between two places—if at all practicable—was chosen as the best. Hence the old Roman roads were generally

straight, and there are facts and traditions referring to their proceeding in direct lines from Rome to London and most of the other provinces of that vast empire.

The same principle was exhibited in most of the older carriage-roads—straight lines from the nearest highway to the mansion; and these, overshadowed by over-arching trees, were the rule. Hence the origin of the avenue, with all its arboreal magnificence and simple grandeur, some grand relics of which may yet be found. But they were well-nigh universal until Capability Brown laid his heavy and sharp axe to their roots during a period of wild and unreasoning reaction from the stiff and formal into meandering lines of beauty. Curved lines carried fashion and society so thoroughly with them, that grand avenues which had stood for centuries were levelled with as little compunction as if they had been the mere upshoots of yesterday.

But this is not the place to discuss the influence of fashion on the art of road-making. No sooner, however, was the straight—that is, the shortest—route abandoned for the curved, than the dangers and difficulties of road-making vastly increased. Almost any one could design or choose the best straight line between two objects—the entrance-lodge and house or mansion—but once deviate from this, and to many it would immediately seem that some rejected line was as good as the selected, or better; and no doubt it often is so.

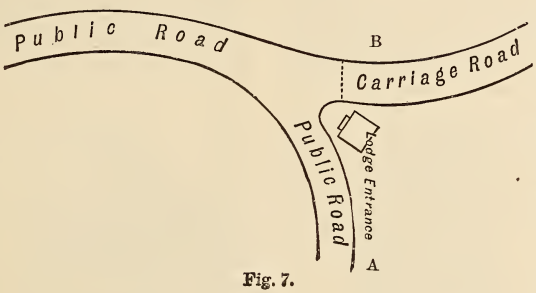


Fig. 7.

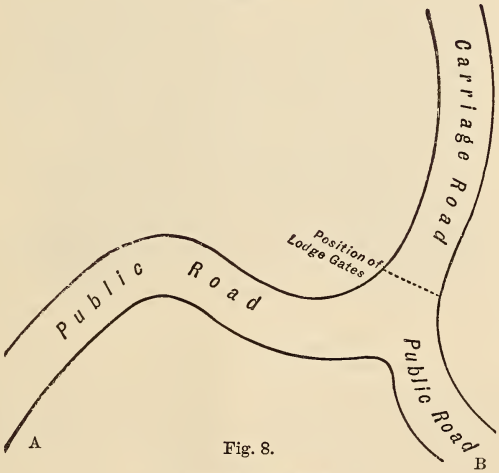


Fig. 8.

Carriage Entrances.

Laying Out.—Taste is capricious, but not despotic, and were its laws more generally understood, possibly it would no longer be felt to deserve its character even for caprice. Be that as it may, there are certain general principles that apply to the lines of carriage-roads, and the nearer they approach to these the more satisfactory and pleasant they will be found. The first of these principles is that the road, at all points of its course, should be obviously a road to the house. There could be no mistake about this when the roads were straight, as they mostly ended in front of the mansion or house, and had the latter for their chief centre and ornament along a great portion of their course; but with curved lines comes a certain amount of freedom which may easily run into licence, and it needs much art of the highest character to distinguish large, easy, natural, and necessary curves, and small, meaninglesss, and offensive bends for the sake of winding. Further, the line should never seem to lead away from the house. This is among the most trying and frequent faults of many carriage-roads. Glimpses of the house are seen, and the road seems making straight for it, when suddenly it bends off into a provoking divergence almost in an opposite direction. So obnoxious and provoking are such lines, that pedestrians mostly quit the road and take a short cut across the grass, to the disfigurement of the latter, and as a natural and emphatic protest against capricious, and consequently false, lines of beauty.

Some object to curved lines *in toto*, because they add to the length of the road; but if properly graduated, the additional length is far less than is generally supposed, as it has been calculated that were a straight road ten miles long so much curved that not more than a quarter of a mile could be seen from any one point, it would not be lengthened in the process more than a quarter of a mile. And every reader will admit that the improvement and additional pleasure to equestrians and pedestrians alike would be well worth this trifling addition to its length. A great mistake is often committed in the carrying of approach-roads too near to the boundary

line of a demesne, either for the sake of adding to its length, or for giving it bolder and more numerous curves. Though the concealment of boundary lines is often carried to ludicrous extremes, yet that does not make their obtrusion less offensive to propriety and good taste.

The opposite evil is even more common—that of carrying a meandering line of carriage-road through the middle of a comparatively small park, and by such means reducing it to meanness or insignificance. In cases where it seems desirable to deviate from what would obviously prove on the whole the nearest way to the house, either natural or artificial obstacles—the latter being made so like nature as to be mistaken for such—should intervene to compel the deviation. To manage these with judgment and effect are among the most difficult efforts, and, when successful, are reckoned amongst the highest triumphs of landscape gardening.

Entrance.—The line of carriage-road at its point of divergence from the public road is also of the utmost importance. Where a demesne is of considerable size and the choice considerable, it should never, if it can possibly be avoided, diverge from the highway at right angles. By taking advantage of bends in the highway or byway, it is generally practicable to diverge so easily and naturally as to make the carriage-way appear, as it were, a continuation of a part or the whole of the main road. This imparts great dignity and importance to a house at a very trifling cost, and may often be managed without adding seriously to the length of the carriage-road. In cases where the carriage-road proceeds for any distance almost parallel with the public road, it is very important that the one should be hidden from the other, as it would generally be considered vulgar taste and a mere ostentatious assumption of an unreal extent of property to lengthen the carriage-way beyond what was needed to afford an easy and commanding entrance from the public highway.

In Fig. 7 the carriage-road is in effect a continuation of the public highway on its main line; but, of course, on coming from the right at A, a sharp bend would occur in making for the carriage entrance. This might have been avoided by throwing the lodge further back, and carrying the road round a gentle curve from A to B. As a rule, however, carriage entrances planned as in Fig. 7 answer all practical purposes well, the public road, A, being but little used. In cases where there is much traffic in that direction, it is common to have a second carriage-road join the public road at some distance beyond the house, thus rendering access to the house of equal importance from all points.

In Fig. 8, however, it will be seen that the peculiar bends in the public highway—and these can be generally found or readily made at a trifling expense—are of such a character that the carriage-road is equally commanding whether entered from A or B. Few things add more to the pleasure and safety of carriage-roads than such easy and commanding lines of egress and access.

The effect of avenues is also at times greatly augmented by taking advantage of straight pieces of highway running in the same direction, which at a distance gives all the practical and perspective effects of a continuation of the avenue. As straight roads are, however, rather rare, it is comparatively seldom that these can be utilised by the carriage-road designer, whereas handy curves, semi-natural-looking bends, can mostly be found if looked for, or easily made by very slight diversions or widenings of public highways in proximity to carriage entrances.

Finally, the house should not be seen too far off, nor often lost sight of after being seen; or a sense of weariness and of unnecessary length for length's sake are apt to be engendered that are anything but pleasant first impressions of a demesne. On nearing the house the road may approach and, as it were, bear down upon it at right angles, or enter the carriage front on one side. The first is generally chosen for avenues or carriage-drives that start at right angles from the mansion and proceed straight from it for some distance; the second for those that wind or bend almost immediately they leave the house.

Furnishing the Sides of Roads—Avenues.—The use of trees for this purpose is probably as old as the art of road-making. It is not unlikely that the planting of single, double, or several rows of trees to furnish shade and shelter and define boundaries preceded the making of roads, and, by concentrating traffic, rendered the making of roads needful. Be that as it may, avenues of trees on either side of roads were at one time almost universal. These were mostly formed of single rows on either side, but often double, and sometimes three or more rows were used. A double row on either side added a greater wealth of arboreal grandeur to the road, and also furnished space for a most enjoyable foot-path between the rows. There are few more suitable or imposing modes of furnishing the sides of the highways or of private roads than by planting them with suitable trees at proper distances.

Among these the Plane, Lime, Beech, Sycamore, Oak, Elm, Poplar, Spanish and Horse-chestnut, Birch, and in damp situations the Alder, are the more suitable; the wild Pear and Cherry, the Walnut, the stronger-growing Apples and Pears, the Mock Acacia, and other trees, would also make effective avenues.

Fashion in trees has so greatly changed within the last few years, that deciduous avenues have been greatly threatened by evergreen ones. The rage for coniferous plants has been so great that it has found an outlet in avenues, and hence one often meets with lines of Wellingtonias, Araucarias, and the finer Silver and other Firs, the majority of which impart but slight shade or beauty to the roadway, and do less in their serried lines of unequal stature to recommend themselves as avenue trees. Where an evergreen avenue is wanted, there are few trees to equal the Douglas and common Spruce, the common Scotch and Silver Firs, and the Cedar of Lebanon and Atlantic varieties of the same, for forming it. Marshalled lines of Scotch Firs, with their ruddy stems and dark, almost black, massive tops, are simply magnificent; and the Silver Fir, from its free growth, its semi-glaucous hue, and its clear fine boles, is even more effective.

Fig. 9.—Avenue of Sycamores.

Width of Avenues.—This will, of course, vary considerably, according to the character of tree employed and the vital difference between mere lines of trees on either side of the road, and avenues over which the trees are to form an arch. Hence, the distance may vary from thirty or forty feet in the case of Limes, to a hundred or a hundred and forty feet in the case of Cedars of Lebanon.

Then again, there are Poplars and Poplars, Elms and Elms, and so of other species in general. The upright pillar or pyramidal Lombardy Poplar might be planted much more closely than the *Populus alba*, *P. monilifera*, or *P. Canadensis nova*. The former shoots up like a spire or the pyramidal Cypress; the others spread out broad and wide, as an umbrageous Oak, Elm, or Horse-chestnut. The distance must vary with the trees employed; the distance from tree to tree in the row is a matter of far less moment, as in avenue-planting the effect in line or mass, and not of individual trees, is the one thing desired. When two or more lines are used on either side, these may be planted so closely as four feet, or as distant as forty; the closer almost the sooner will the avenue be formed.

The former are generally the more effective, but sometimes the latter may be adopted with excellent effect; and as far as the road view and effect are concerned there is but little difference; but the outside outline of the avenue may be thus infinitely varied, here narrowing into a mere line or double line, and there swelling out into a mass or clump of trees, thus securing all the solid advantages of avenues, and at the same time most of the charms of supporting roads with detached clumps or plantations of suitable trees.

Fringing with Belts or Clumps of Trees.—As first impressions are said to be the most durable, it is well that approach and other roads to a demesne should be made as pleasant and fringed with as much beauty as may be. This, however, must never be carried so far as to leave little more to be revealed in garden or pleasure-grounds; but a great variety of arboreal and shrub beauty may be displayed on the sides of the carriage-drive without any danger of such a disappointing sequel.

Laburnums, Thorns, double-flowering Cherries, evergreen Oaks, the flowering Ash, the smaller Acacias, common Golden and Silver Yews, Sumachs, Berberries, Guelder Roses, Syringas, Lilacs, Spireas, Hollies, Laurels, Kalmias, Azaleas, Rhododendrons, Heaths, Laurestinus, Sweet Bays, furnish almost a prodigality of material for these purposes.

Edgings to Roads.—As to these, grass is the most natural and best edging for carriage and all other roads; it should never exceed an inch and a half or at most two inches in depth. Where shade, such as passing through thick woods, kills the grass, Ivy, Periwinkle, St. John's Wort, or other plants, may be substituted. Neither need the grass, unless in the case of avenues, be of one uniform width. On the contrary, here the shrubs or the trees might advance almost to the gravel, and there

recede to any desired distance; a single tree or group of shrubs being occasionally introduced to give force and meaning to the retreat of the turf.

Some of the most delightful carriage-roads in the country are those that are supported—or rather, illuminated when the plants are in bloom—with rhododendrons chiefly or only; thousands and tens of thousands of these plants are employed to advance and rest on the turf or gravel at one side, and rise up boldly and meet and mingle with the trees on the other.

Garden Walks.—The same general principles apply to these as to roads; but as one of their chief uses is to provide a pleasant promenade and furnish healthy exercise within one's own domain, any reasonable extension of walks within the limits of good taste may be permitted. Still, mere meandering for the sake of lengthening must not be indulged in. One of the most striking examples of this fault ever seen by the writer was that of a zigzag walk carried through a belt of wood about fifty feet wide. The walk skirted both sides of the belt, and was so bent and curved that every now and again the two walks came within a few feet of each other.

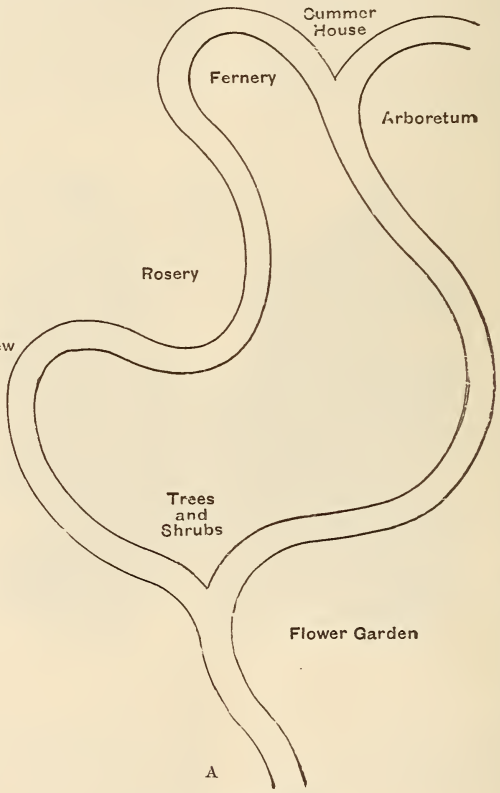


Fig. 10.—Lines of Beauty.

A definite and satisfactory meaning may mostly be given to the curves of walks by the opening out of distant views of the surrounding landscape, or posting objects of interest, such as a choice tree, or shrub, or group, a seat, arbour, or statue, at particular points. By such means the course of the walk may be made to seem natural, and even necessary, and the most convenient. As a general rule, pleasure-ground walks are best curved; the line of beauty seldom or never being a straight one. Hence, to give object and meaning to the curves becomes one of the first duties and the highest merits of the true landscape gardener.

In Fig. 10 the primary object is to illustrate lines of beauty, and show what they are like to the uninitiated; the secondary purpose, so to dispose different objects of interest as to make the lines chosen seem the most natural—almost, in fact, the only available ones. Hence, in proceeding from the house, which is in the direction of A, the first curve in the walk is caused by the flower garden, that compels a slight divergence to the left. Proceeding a little further, a dense group of trees and shrubs blocks the way, and compels the walk to diverge to the right and the left. Choosing the right-hand path, it would scarcely be possible to choose a more graceful curve through a grass lawn to the collection of trees planted in the arboretum. The walk diverging to the right at this point leads to the dairy and home-farm. The sharp divergence here is rendered necessary by the summer-house that again blocks the way; it commands a view of the walks, and the meadows and corn-fields on the other side of it. Of course, the summer-house might have been made the terminus of the walk. But it is generally unsatisfactory to be compelled to return on the same walk, where the pleasure-grounds are sufficiently large to afford the means of returning by another. In this case, too, there are other reasons for turning to the left at the summer-house—a fernery to visit, a rosary in the recess further on to enjoy, and a commanding view of fine landscape, &c., in the near foreground, with a meandering river coiling through verdant meads, like a silvery serpent, in the far distance. Thus the interest of the walk is sustained at all points, and the curves are so adjusted and worked in to surrounding circumstances as to seem that they could hardly have been otherwise. The difference in walking on such walks, contrasted with the dreary monotony of taking constitutionals on straight lines or round

ovals, circles, or meaningless curves, repeated *ad nauseam*, must be tested by experience to be fully appreciated.

Lines of Divergence.—This is a point of great importance. Unless in the case of straight walks, they should seldom diverge at an abrupt or straight angle, but rather glide softly and easily into one another. The primary idea of pleasure-ground walks should be that of leisurely enjoyment. Hence, all sudden and abrupt changes or turnings should be avoided. To diverge at right angles suggests a summons to business, rather than a stroll for pleasure. Such sudden changes and abrupt turnings are quite in harmony with street traffic and business pursuits, but incongruous to garden pursuits and pleasures, and therefore out of place in pleasure-grounds. The illustrations show how they may generally be avoided.

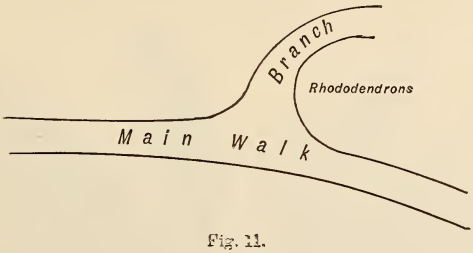


Fig. 11.

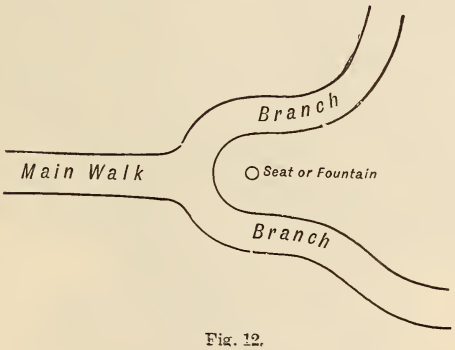


Fig. 12.

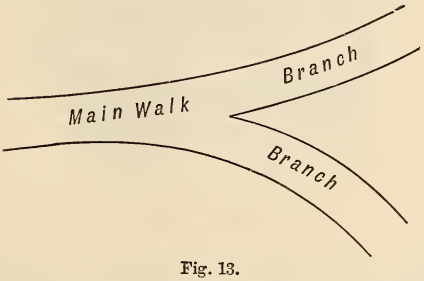


Fig. 13.

Lines of Divergence.

In Fig. 11 the divergence of the walk is forced by a dense group of Rhododendrons. The same principle is exhibited in Fig. 12, where a seat or fountain compels a turning of the walk to either side, or to both. The latter is generally preferable and the more pleasant, and avoids any mental questionings as to why one side, and that probably considered the worst, should have been chosen rather than the other. By continuing the walk on both sides all this is avoided, more pleasure is realised, and ideas of larger extent conveyed. In Fig. 11 the main walk is, as it were, continued almost straight, and the branch walk is narrower, and turns sharply to the left. As a rule, the system of narrowing the walks at the point of divergence is not only a convenient one, but furnishes as it were an additional reason why they should diverge. Up to this point a main walk was needful for the common traffic. From here two or more points of interest of equal moment claim attention, and hence two or three narrower walks may suffice. There is one point in Fig. 11 that may be adverted to as a warning—the branch seems at starting as if it were about to rejoin the main walk. This should always be avoided, the walks diverging boldly, as in Fig. 12. Here the branches are little narrower than the main walk, and the two branches are assumed to be of equal importance from the seat or fountain onwards. It will be seen that they boldly diverge from each other, as if they never meant to meet again. All this is based on the soundest judgment and the truest taste. If walks seem at starting about to meet again, the question is sure to arise, Why part them? Of course, in small gardens the curves, departures, re-meetings, and final coalescings of walks may all be seen, even from the starting-point. The small area renders this unavoidable. But that cannot be offered as any excuse for not avoiding such faulty features in the disposition of roads or walks in gardens of larger area.

Fig. 13 shows another and still more common mode of divergence. The two lines simply form an angle on the grass or gravel, and proceed on their allotted course, either of equal or unequal size. In the figure the two walks are of the same breadth as the main walk. The divergence is also so managed that no one can tell whether the right or the left is the branch. In the plan they are both designated "branch." They might, however, with equal propriety be termed mains, both walks in the illustration being of equal importance. In cases where it is otherwise, the angle of divergence should be so disposed as to continue the principal as the main, and show the smaller to be a branch or side walk.

These illustrations have all been confined to two walks. It is equally easy to show three or more proceeding from one point. The writer has seen even five, and in one instance eight. In the latter case, however, a fine group of sculpture formed a centre-piece, on which eight straight walks converged. Each of these was also terminated at the far end with a vase or a pyramidal tree. This was an example, however, of the convergence rather than the divergence of walks, and was by no means satisfactory.

Five lines of divergence are several too many, four are seldom artistic and pleasing, and even three are apt to prove embarrassing, and to give rise to mental doubts and questionings, which somewhat mar the leisurely pleasure of walking in gardens. Two lines at one spot are on the whole in best taste, and hence none others are given here, though similar principles apply to the many as the few.

Privacy in Walks. — Roads running nearly abreast in one direction always suggest a waste of space, or of material, or of both. And it is just the same with two walks; but in these another vital objection lies against their contiguity, that is, the destruction of their privacy. This is one of the chief charms of gardens or pleasure-grounds; robbed of their privacy, one might as well walk in the public streets as their pleasure-grounds.

Hence, where the grounds are narrow, or where it is desirable to go and return by different routes, the importance of carrying the walks by differing levels if practicable, or of so planting the grounds between as to hide the two walks from each other; or a raised bank may be constructed, to be planted with thickly-growing shrubbery and a few trees, which will effect an entire separation of the two walks. By such means not only may more perfect privacy be obtained, but also the apparent extent of the grounds be very much enlarged.

Asplenium Nidus.

FERNS.

By James Britten, F.L.S.

Asplenium.—The genus *Asplenium*, as understood by the authors of the "Synopsis Filicum," the standard authority on ferns, is a very extensive one. In number of species it occupies the second place in fern genera, and includes plants from all parts of the world where ferns grow. Within the limits of the genus every variety in size, in texture, and in the cutting of the frond is comprised, most of the species being evergreen, and a large proportion of them highly desirable and ornamental plants. At present the species formerly classed under the genera *Thamnopteris*, *Hemidictyum*, *Anisogonium*, *Diplazium*, *Athyrium*, and *Darea*, are included in *Asplenium*, which now numbers about 350 species. In the vast majority the veins are free, simple, or branched, and the sori are linear or linear-oblong, the involucre being the same shape as the sorus. Now and then the sori are more or less curved; sometimes, indeed, horse-shoe-shaped, as in the section *Athyrium*. As it would be impossible within the limits proposed for this work to mention very many of the species—a considerable number of them not yet having found their way to cultivation in this country—a selection of the best and most distinct, from a garden point of view, is given under the different heads of Stove, Green-house, and Hardy.

Asplenium Hemionitis.

STOVE KINDS.

A. alatum is a handsome species from the West Indies and tropical America; from a thick fleshy crown it produces an abundance of pleasing light green pinnate fronds, which gracefully arch over, and render the plant a thoroughly suitable one for cultivation in baskets. *A. auritum* has also bright light green pinnate fronds, from a foot to a foot and a half in length; in addition to the countries given for the last-named species, this is also found in the Neilgherries, in Bourbon, and in Madagascar. One of the most handsome and distinct of all the Aspleniums is *A. Belangeri*, from the Malayan peninsula, Java,

Sumatra, and Borneo. The deep green feathery bi-pinnate fronds, of a somewhat leathery texture, measure from one and a half to two feet in length, and bear a profusion of young plants—this viviparous character affording a ready means of increasing the stock of such a useful and elegant subject.

A. bissectum hails from the West Indies and Ecuador; it is of tufted habit, with pinnate fronds about two feet long, the firm, erect, chestnut-brown, nearly naked stipe measuring about four or six inches in length; the frond is made up of twenty or thirty pairs of horizontal deeply-cut pinnæ two or three inches long. *A. caudatum* has firm erect tufted stipes about four to six inches long, densely clothed with fine brown fibrillose scales; the beautiful dark glossy green pinnate fronds, twelve to eighteen inches long by four to eight inches broad, are composed of twenty or thirty acuminated deeply-toothed pinnæ on each side of the villose rachis; this species has a very wide geographical distribution, being found in a wild state in Polynesia, Malaya, Australia, Hindostan, Comoros, Angola, Ecuador, and Brazil. *A. cicutarium* is a handsome species, with delicate green, feathery, tri-pinnate, shortly-stalked fronds, from six to eighteen inches in length, and four to six inches in breadth; it is a native of tropical America, and is also found in Abyssinia, and on the Guinea coast.

A. crenulatum, in common with *A. lanceum*, *A. latifolium*, *A. Shepherdii* and *A. Thwaitesii*, mentioned below, belongs to the section *Diplazium*, in which the veins are free, the sori and involucres extending to both sides of some of them. This species has an erect subarborescent caudex, and firm, erect, slightly furfuraceous stipes, twelve to eighteen inches long; the fronds, with fifteen to twenty pinnæ on each side below the pinnatifid apex, measure two to three feet long by nine to fifteen inches broad; it is found in a wild state from Cuba and Mexico to Brazil and Ecuador. In *A. dimorphum* considerable differences in general appearance are exhibited between the barren and the fertile fronds, the former being bi-pinnate, with broad and somewhat toothed pinnules, and the latter tri-pinnate, with very finely-divided pinnules; this is a noble species, with large, gracefully arching, shining dark green fronds, which, like those of *A. Belangeri*, previously mentioned, are very proliferous, and thus furnish a speedy method of propagation.

A. lanceum has nearly entire, leathery, slightly undulated fronds, six to nine inches long by three-quarters to one inch broad, and slightly fibrillose stipes, four to six inches long; it is a native of the Himalayas, Ceylon, China, and Japan. *A. laserpitifolium* is a handsome, large-growing species, with finely-cut fronds, some two to four feet long by six to eighteen inches broad, surmounting firm, erect, greyish, naked, tufted stipes, six to twelve inches in length; this is found from the Polynesian Islands and North Australia, northward to Chusan and Assam. *A. latifolium* has an erect subarborescent caudex, and strong erect tufted stipes, a foot or more in length (clothed towards the base with narrow dark brown scales), and thin pinnate fronds, two to three feet in length by nine to eighteen inches in breadth; in a wild state this occurs in Ceylon, the Neilgherries, South China, and the Philippines. *A. myriophyllum* is an exquisitely beautiful fern, with somewhat the aspect of *A. cicutarium*, but the fronds are a darker green, and more graceful and feathery in outline; it is a native of tropical America.

One of the most strikingly distinct, and, in a certain sense, one of the most useful of stove Aspleniums is *A. Nidus*, the Bird's-nest Fern, so named from the hollow nest-like centre, caused by its peculiar habit of growth. This is the best known of a small section—with undivided fronds and veins, connected at the apex by a transverse intra-marginal line—formerly referred to the genus *Thamnopteris*. The lanceolate, leathery, dark glossy green fronds measure when fully grown two to four feet in length by three to eight inches in breadth. A popular writer on ferns has called this "a sublime Hart's-tongue," and this descriptive phrase certainly gives a good idea of the general aspect of the plant. Good-sized plants of this species have been used with great effect, during the summer months, in sheltered shady spots for so-called "sub-tropical" work. *A. Shepherdii*, a tropical American species, has thin, bright green, pinnate fronds, twelve to eighteen inches long by six or nine inches broad, surmounting firm, erect, tufted, greenish, scaly stipes a foot in length. *A. Thwaitesii*, from Ceylon, has pale green hairy fronds, a foot in length by four inches broad, with eight to ten distant pinnæ below the pinnatifid apex; the slender green stipes, densely clothed with strong white woolly hairs, measure about six inches in length, and spring from a wide-creeping rhizome. *A. viviparum* has beautiful dark glossy green, finely-cut fronds, one to two feet long; in common with several other species, the upper portion of the frond develops a profusion of young plants, which grow rapidly if the frond be pegged down on damp soil. It is a native of Mauritius and the Bourbon.

Cultivation.—The Aspleniums as a rule, at any rate the stove and green-house species, present no especial difficulties to the cultivator. The stronger-growing kinds flourish in good loam and leaf-mould, and are especially benefited by the repeated administration of weak liquid manure during the growing season. Some few kinds seem to thrive best in pure peat and sand. *A. viviparum* succeeds well under

this treatment; whilst *A. Nidus*, for instance, does well in pure peat mixed with chopped sphagnum. The majority of the species take very kindly to a mixture of peat, loam, and leaf-mould, with a slight addition of sharp sand. All require frequent syringings during the season of growth, and a moist atmosphere throughout the year. Good drainage is an essential in every case. Although many seem to stand full exposure to direct sun-light under glass fairly well, they seem to produce finer and more deeply-coloured fronds when grown in partial shade.

GREEN-HOUSE KINDS.

On account of its rapid growth, its elegant appearance, and the ease with which it can be successfully grown, even with limited means at command, *A. bulbiferum* is deservedly one of the most widely known as well as one of the most popular of green-house ferns. The handsome pale green fronds, which sometimes attain a length of two feet, are now and then so heavily weighted with their crop of young plants as to cause them to assume a pendulous position. As might be expected in the case of a fern having such a wide geographical distribution—it is found in New Zealand, Australia, New Caledonia, &c., Samoa, North India, tropical America, Bourbon, &c., and Natal—a number of forms have been regarded as species; amongst the most distinct of these are *A. laxum*, with more slender habit and narrow segments, and *A. Fabianum*, with narrow divisions and submarginal sori. *A. falcatum*, a widely-distributed fern throughout the Southern Hemisphere, resembles a good deal the *A. caudatum*, mentioned among the stove species; probably *A. erosum* is only a West Indian form of *A. falcatum*. *A. flabellifolium* is a delicate little species from temperate Australia, Tasmania, and New Zealand; it is particularly adapted for cultivation in small-sized baskets, as under these conditions its slender bright green fronds are seen to greatest advantage; it also makes an excellent subject for fern-cases, as its arching fronds are proliferous at their tips, and root freely on contact with the ground.

A. flaccidum, a very variable plant from New Zealand, Australia, Van Diemen's Land, &c., is excellent for growing in a basket; its pendulous, bi-pinnate, rich deep green leathery fronds often attain a length of three feet. *A. furcatum*, widely distributed throughout tropical and sub-tropical regions, has leathery fronds six to eighteen inches long by four to six inches wide; this species may be likened to a magnified specimen of our native Black Maiden-hair Spleenwort. *A. Hemionitis*, a native of the Western Mediterranean region, is a pretty dwarf species, of which the illustration renders a description unnecessary. *A. incisum*, from Japan and West China, resembles our native *A. lanceolatum*, but the fronds are narrower in outline and thinner in texture. *A. monanthemum*, with the general aspect of the Black Spleenwort (*A. Trichomanes*), is one of the prettiest of small-growing green-house evergreen ferns; the bright green pinnate fronds now and then attain a length of eighteen inches. Bulbules are often produced in the axils of the lower pinnæ. This species has a rather

A. FELIX-FŒMINA, VAR. PLUMOSUM.

peculiar distribution, being found in Madeira, Azores, Abyssinia, Cape Colony, the Sandwich Islands, and Mexico, along the Andes to Chili. *A. obtusatum*, of which species *A. lucidum* and *A. obliquum* are mere varieties, seems to the casual observer like a large edition of our native Sea Spleenwort, *A. marinum*. Although rather formal for pot-culture, this makes a fine object for the green-house rockery; and, indeed, when planted out in the open border of the perfectly cool conservatory, its leathery evergreen fronds are produced in great abundance, and attain to a large size. This species is abundant in a wild state in New Zealand and Australia, and is also found in the Polynesian Islands, Peru, and Chili. *A. Hemionitis*, with its light green fronds, which are halberd-shaped in outline, with a triangular acute terminal lobe, and two large cordate acute lateral ones, each again bluntly or acutely lobed, is a very distinct and striking species. It is found in Spain, Portugal, Barbary States, Azores, Canaries, Madeira, and Cape Verde Islands.

A. FILIX-FŒMINA, VAR. CRISPUM.

Cultivation.—Our remarks under stove species apply to green-house ones also.

HARDY SPECIES.

In this group, except in very favoured spots in the South and South-west of Britain, few except our native species can fairly be placed. These, however, exhibit considerable differences in size and general appearance, and have beauty enough to recommend them to the fern-lover, in addition to the interest which attaches to some of them on account of rarity. The small number of species, too, is amply compensated by the enormous number of garden forms of such as the Lady Fern, *Asplenium Filix-fœmina*—formerly (and sometimes now) looked upon as distinct from *Asplenium*, and generally found in nurserymen's catalogues under the name of *Athyrium Filix-fœmina*. This species, both in a wild state and under cultivation, varies excessively, some of the garden forms betraying to the uninitiated no trace of their real relationships. Among the best of the varieties with non-crested fronds are *latifolium*, *rhæticum*, and *plumosum*, the latter being the most finely cut and handsome of the entire set. Of those with variously crested fronds, a good selection is *crispum*, *corymbosum*, *depauperatum*, *Victoriæ*, *Fieldiæ*, *Frizelliæ*, *polydactylon*, &c. All of these grow freely enough in any moderately moist shady spot, and are invaluable in the out-door rockery. They will not thrive in places where stagnant moisture abounds; given a spot clear of the latter, and commanding shade, they are indifferent to soil.

A. Adiantum nigrum and *A. lanceolatum* like a moist but well-drained spot, and succeed well in any soil containing a fair share of decayed vegetable matter.

A. viride, the Green, and *A. Trichomanes*, the Black Spleenwort, thrive well in any well-drained "pocket" of the rockery, with leaf-mould and sand mixed with pieces of stone—pieces of old brick rubbish do thoroughly well; indeed, wedged between the brickwork of an old wall, and kept damp until the roots have had time to fix themselves in their new quarters, when the plants will need no further attention, they will often grow more luxuriantly, and look much more beautiful, than when grown in pots. Crested forms exist of the last-named species, and also others with pinnules deeply cut; the best of both sections are *incisum*, *cristatum*, *depauperatum*, *multifidum*, and *ramosum*.

The Wall-rue, *A. Ruta-muraria*, and the Scale-fern, *A. Ceterach* (often given in catalogues as *Ceterach officinarum*) require very perfect drainage; the former does best wedged between pieces of limestone or old brickwork; the latter also succeeds well, and reproduces itself freely enough, under similar conditions. The Sea Spleenwort, *A. marinum*, of which hundreds of bunches of fronds are weekly imported to Covent Garden Market from the South of Europe for household decoration, likes a sheltered spot amongst pieces of sandstone. *A. fontanum* and *A. Germanicum* succeed well either as pot plants, using loam and leaf-mould mixed with small bits of limestone in well-drained pots, or in the open rockery, where care is taken to prevent access of superfluous moisture. Perhaps the most difficult to manage of all the hardy Spleenworts is *A. septentrionale*, which in most places succeeds best in a cold frame, using thoroughly well-drained pots and a compost made up of sharp sand, a small quantity of leaf-mould and loam, and a large proportion of small pieces of soft stone.

ASPLENIUM FONTANUM.

The Onychiums.—The genus *Onychium* contains but four species, and only two of these have yet been introduced to cultivation. It belongs to a large group or tribe, the *Pterideæ*, of which the genera *Pteris* and *Adiantum* are familiar examples. Indeed, by some authorities *Onychium* has been united to *Pteris*, from which the species mentioned below differ rather in the cutting of the fronds, and the smallness and narrowness of the ultimate segments, than essentially in fructification. There are few more graceful and elegant ferns than *O. auratum* and *O. Japonicum*. Both succeed well in a cool house; indeed, in structures where no fire-heat

is at any time available, the latter often thrives admirably. So fine, indeed, are the ultimate divisions, that it is difficult in non-technical language to give a fairly correct idea of the beautiful and delicate tracery of the fronds.

O. auratum owes its name to the rich golden-yellow colour of the membranous involucres and numerous sori. It is a native of the Malayan Peninsula and Islands, and also of the Himalayas, where it ascends to elevations of 5,000 feet above sea-level. The stout, smooth, straw-coloured or pale brown stipes measure from six to twelve inches in length, and the ovate fronds a foot or more in length by about six inches in breadth. *O. Japonicum* is distributed throughout Java, Japan, China, and the North of India, where it ascends in Sikkim to elevations of 9,000 or 10,000 feet above the level of the sea. This species is somewhat like the last in size and general appearance, but the membranous involucres are pale-coloured, and the sori are brown.

Cultivation.—Both the species mentioned are of neat tufted habit, and make excellent subjects for cultivation in pots for cool house decoration, or for planting out in the fern-case. A mixture of peat and sand with a little leaf-mould suits them thoroughly, and well-drained pots only should be used; good examples can be grown with but limited root-room. *O. Japonicum* is the hardier of the two, and will even succeed in the open air in thoroughly sheltered spots in favoured localities of the South and South-west of England.

GROUND OPERATIONS.

DIGGING.

OF all athletic exercises, with perhaps the single exception of cricket—and it is doubtful if that is an exception—the very best is digging. Probably every single muscle, vein, artery, and nerve in the body is vigorously exercised in the process. There is the weight of the spade, the power expended on the thrust, the loosening force, the lifting weight, the skilful and rapid inversion of the mass, the throwing power, the levelling tact, calling and keeping in vigorous exercise almost every function and capacity alike of body and of mind: for digging is a science as well as a practice, it needs thought as much as physical strength, and, like most sorts of what is called manual labour, it will be found mostly to be good or bad according to the measure of thought put into it.

Every Man his own Digger.—Why not, as well as every man his own brewer, baker, lawyer, and what not? The process is infinitely more simple and far more sanitary than either of these, and countless other things that every man is advised to become, be, or do for himself in these days of advice gratis *ad libitum*.

There is no constitutional, no aid to digestion, no cure for the blues, no receipt for a good night's sleep, no quietus for excited brain or ruffled nerves, to match half an hour at honest digging once or twice a day. Most of the above evils are born of mental strain, worry, anxiety, monotony of labour, the dreary treadmill exertion of counter or desk, and they fly like bats before the day-dawn, at sight, sound, or touch of gleaming bright spade thrust into the earth. Let the tired and the wearied, the drooping, those almost ready to faint, borrow leave to dig in their neighbours' gardens, if they can neither hire nor purchase one of their own.

But meanwhile, let all the fortunate possessors of gardens hasten to do a whole or a part of the digging themselves. It is really the best work in the garden. Not a few owners slave over cleaning, dressing, watering it, and only *have a man* to do the digging. This is beginning at the wrong end—setting the labourer, in fact, to do the master's work. Custom has reconciled society to this order. But looking at it from a sanitary and business point of view, it is nearly as bad as sending the porter to the bank while the merchant sweeps the office. Good digging is to the garden what the merchant's skill and forethought are to his profits; yet honest digging has almost become the exception; a sort of shambling, shuffling inversion of the soil the rule. And yet, properly understood, and skilfully practised, the former is more easy than the latter.

Ladies' Garden Tools.—Ladies are most cruelly handicapped with these. The majority of the prettily got-up sets for ladies are made of iron only: pretty, very pretty, but villanously bad. In fact, as a rule, they are not made for use, only to look at. So soon as they come in contact with the ground, they either stick fast or get so coated with soil, that it would need a man's strength to work with them, small as they are. The same tools are also used by boys; and no grown-up man who has ever had to work with ladies' or children's spades or other tools can wonder that, as a rule, they are so little used.

The smaller the tools the better their quality must be. This is only reasonable, as their very smallness proves they are for those who are comparatively weak; and the better the tool, be its size what it may, the lighter it is to use. This is emphatically true of spades. Hence small spades should be made

wholly of steel, kept bright as a steel fender, either by honest digging or careful scouring, or both. The edge of such spades will be almost as sharp as a carving-knife; no load of soil can cling to them, and the friction in use will be reduced to a minimum. Larger ones should be wholly of steel or plated with it on iron, the steel plate doing all the cutting, keeping the spade clean, and preserving it in form, as the steel may break, but cannot rust nor bend.

Plotting out the Ground—The Opening.—A similar course to that recommended for trenching is adopted, though not carried to the same extent. A space should be cleared at least a foot wide and a foot deep for ordinary digging. Some clear more, many attempt to do the work with less, but a foot is a safe and convenient average. In cases where a heavy coating of manure is dug in, a wider opening is desirable. One of the most important points in digging is to keep this opening clear and of one uniform width throughout; otherwise the work will get confused and be badly done, especially by amateurs.

Importance of a Straight Line.—It matters little to experienced workmen how the land lies, but very much indeed to those who are but learning the art of digging. Hence the ground should be set out by rod and line to start with, and the next piece to be dug, whether twelve, nine, or six inches, also marked off with a notch cut out with the spade along the line. Then standing firmly on the undug ground, if the work is to be done towards the left, the spade is grasped with the right hand on and through the eye, and the left hand just under it. The left foot is then placed firmly on the head of the spade, and its pressure and the thrust of the hand send it down its whole length into the ground; the spade is suddenly drawn back towards the digger, with the load of earth on it, and at the same moment the back is bent, the left hand placed lower down under the handle, the spadeful is lifted up and neatly inverted, and forms the newly-dug portion of the ground-line.

One or two points need special attention during the performance of the simple, yet compound, operation of digging. The spade should be thrust in a line perpendicular to the surface. One of the surest signs of imperfect digging is a long sloping side against the solid undug ground—the more it is sloped the fleeter the digging—and in this way "spit-deep," as it is called, is often not more than half, or at the most three-quarters, of a spit, or length of the spade. Another point of great moment is the depositing of the spadefuls with neatness and regularity. When the art of digging becomes perfected, these spadefuls will be placed so well at first as to need no touch with the spade afterwards in the case of rough digging. There is no surer test of skill in digging than the measure of interference with the ground on the newly-dug surface. The less interference the better the digger, and *vice versâ*. The bad digger seems as if he would never leave the earth alone after its inversion; the good touches it not at all, unless it needs breaking.

Changing Hands.—Comparatively few labourers ever learn to change hands in digging. In the North, where the young gardeners do all the digging and take pride in their work, the art of digging has been elevated almost to the level of a science; and the lad or man who could not change hands at the end of his stitch, and dig equally well with his face to the ground he had dug, from left to right as from right to left, was considered an inferior workman. Hence, no sooner was the end of the brake or stitch reached, than the spade was pitched up with a flourish, the left hand placed on the top instead of the right, and the digger faced round and proceeded in the opposite direction. In digging for health, this change of front and of hands is of very great importance. It brings the whole of the muscles of the body into more equal exercise, giving to each side of the frame exactly the same weight to lift and an equality of movement.

Different Kinds of Digging.—These are the general terms applied to digging—rough and fine. The first in perfection consists of spadefuls just as they are lifted and inverted. The more entire and unbroken the mass, the more perfect the rough digging, provided however that the surface, though rough, be even: that is, the upper surface of the lumps or spadefuls should be all of one height; and this is not only desirable to give a workmanlike appearance, but also for cultural purposes, inasmuch as ground thus roughly dug will be sufficiently level for cropping, when the weather has mellowed the rough clods down into a fine tilth.

Fine digging consists in not only inverting the soil as already described, but in breaking it down fine at the same time. This is done by forcing it over by several thrusts, and, if need be, pats with the back of the spade after inversion. Portions of it may also be lifted and re-distributed, if needful, in order to make the surface more level as well as more fine. This sort of digging is far less practised than formerly, and is mostly confined to digging among flowers or for seed-sowing. For most other purposes rough digging, or a sort of hybrid between that and smooth, is the most general, it being found better for the soil, as well as far cheaper, to allow the

atmosphere to fine down the soil into mould, and confine the spade chiefly to inversion.

Inversion.—This is essential to the distributing and covering of manure, the picking out of the roots of perennial weeds or other rubbish, the burying of the comparatively effete surface soil, and the exposure of a fresh stratum of earth to the ameliorating and enriching effects of the atmosphere.

Best Mode of Applying and Burying Manure. — Professional cultivators mostly spread this on the surface and dig it in, thus inserting it in the bottom of the trench or furrow. Perhaps, on the whole, there is no better way of applying and equally distributing the manure. It is not, however, the only way, which is fortunate, for ladies could hardly be advised to do their own digging under such insanitary conditions. The surfacing with manure before digging also adds considerably to the labour. The manure has to be pierced through, no matter how rank it may be, before the ground is reached. It is also apt to fall on the earth in the act of being turned, and so protrude through the surface of the freshly-dug soil, much to its disfigurement, and also to the inconvenience of cropping. All these evils may be obviated, and the work of digging rendered quite cleanly, and far more easy, by applying the manure to the bottom of each trench or furrow as the work proceeds. By placing a little also on the face or slope of the newly-dug surface, the manure will be just as well, or even better, distributed, and all the drawbacks of surface-dressing the undug surface with manure be prevented.

The Best Time to Apply the Manure to Land.—This is a matter of still more importance than the mode or place to apply it. As a general rule, there is no doubt that the autumnal manuring is best for horticultural purposes. Garden crops cannot use rank manure; and applied early, it will have time to be broken down into useful and available plant-food before the roots of plants need it.

The Depth to Dig.—There is a very general consensus of opinion in favour of a foot, that is, a good spit in depth. Some however, go deeper, or by means of extra thrusting gain three inches or so more depth. Others double-dig, that is, take a part or the whole of a second spadeful; this requires a wider opening or furrow, and really differs little from trenching excepting in name. Shallow or fleet digging is also very common. Not only is nominally deep digging scamped down to a depth of nine or six inches, but differing degrees of shallow digging, termed pointing, are also advisably adopted: for example, ground deeply dug in the autumn is pointed—that is, dug over from three to six inches deep—before being cropped the next summer. This sort of digging is light and easy, and requires no treading of the spade with the foot, the mere force and weight of the spade being sufficient.

The Times to Dig.—Generally digging is characterised as autumn, or winter, and summer digging, though, as a matter of fact, the operation is performed at any and every portion of the season when necessary. The necessity for digging arises the moment a crop is finished on any spot of ground. Vacant ground loses productive or growing force every day that it remains undug, and as crops now succeed each other in far more rapid succession than formerly, so of necessity do successive diggings. Still, the two great divisions of digging into winter and summer are retained, as they indicate, as we have already seen, a distinction in kind as much as one of season, the former being rough, the latter fine digging.

Other Kinds of Digging.—These are what are called bastard, or baulk digging, ridging, and forking.

The name pretty well explains the character of baulk digging. About half of the ground remains undug, and the dug portion is inverted on to the top of the undug ground, leaving about one-half of the ground undisturbed, that is, baulked of its digging. The work is done more rapidly, and a very large area of surface is left to the ameliorating and enriching influences of the atmosphere. If the operation could be performed early in the season, and repeated again about the beginning of the year—digging up the ground that was baulked on the former occasion—this would prove one of the best means of thoroughly cultivating the soil of the garden in winter. As there are various ways of baulk digging, and the easiest is as good as any other—that is, the placing of each spadeful of moved earth upside-down on the nearest unmoved spit beside it—and as this does not involve the removal or transference of any opening or furrow, this baulk digging need not cost more than one-half of that of the usual character.

Ridging up the Land.—This system is often preferred to rough digging. It may be performed in a similar way to bastard or baulk digging, that is, leaving the base of the ridge undisturbed, and placing a spadeful from either side on it. In that case the base of the ridge should be eighteen inches or two feet broad, to receive and retain a full

spadeful from either side. The ground may be either finished off in a series of sharp ridges and deep furrows, or both may be rounded. Either form answers well—the pointed finish being best for wet, and the more round form for less moist climates and localities.

To derive the full benefit from ridging up, the base of the ridge of whatever form should first be dug, and a spadeful from one or both sides placed on the top of it, the entire area of the surface being thus inverted and disturbed. A very simple plan of ridging consists in digging just as in the ordinary way, with the exception that one spadeful may be inverted in the place it was lifted out of, and a second one placed on the top of it. By repeating this process all over the ground, a series of hills and holes, or of small ridges and furrows, will be found that shall expose a maximum amount of surface to sun and air at the smallest possible expenditure of time and labour. When the ground is wanted for cropping, it is simply pointed back in the opposite direction, thus filling up the space left where the ridging up left off.

There is yet another way of ridging up which leaves ridges of better form and equal size at equal distances, say of two feet or thirty inches in width. In such case the bottom of the furrows will be the same distances as the crest of the ridges. Hence, after mellowing all winter, potatoes may be planted in the bottom of the ridges, well dunged either under or over them (it really matters little which), and the ridge, with all its finely-mellowed sides, is split down the middle with the spade, and one-half allotted to either side, and the planting is finished, with a better prospect of success than by any other known method. This ridging of the earth for the sake of its enrichment and amelioration merges into and becomes a very important part of cropping.

The Forking up and over of the Soil.—When steel forks—at once light, bright, and sharp—were introduced, it was thought by not a few that the range of the spade would be from thenceforth greatly limited, if its days were not absolutely numbered. Nothing of the kind has happened, however. Fork-culture has been added to rather than become a substitute for that of the spade. The need of deeper, higher cultivation for the earth arose almost simultaneously with the general introduction of digging-forks. Hence there is room and work enough in most gardens for all and more than both can do. There are, however, some purposes, such as the cleaning of foul land, the rapid stirring, loosening, and intermixing of the soil, its preparation for catch and intermediate crops, for which the fork excels the spade.

Other tools, such as hand-ploughs and harrows, scarifiers, and other implements, have been strongly recommended for garden purposes. To any about to use these, our advice would be, Don't. Stick to the spade and the fork, with an occasional help from the pick, mattock, or crow-bar, and these will be found sufficient for all horticultural operations on the ground.

A hand-roller, for the consolidation and smoothing of the substance and surface of most garden soils, may be said to be almost essential to success. Treading with the foot is the most usual mode of consolidating loose soils, but a small iron hand-roller proves a useful supplement to these primitive compressors, and while indispensable on gravel and grass lawns, is hardly of less use as a clod-breaker than in making a hard bed for onions and other crops.

GREEN-HOUSE PLANTS.

By William Hugh Gower.

Azalea.—A genus of highly ornamental plants, indeed, so popular the flower that many nurserymen devote their whole establishment to the hybridising and cross-breeding of this genus alone; the result is that many hundreds of kinds are in cultivation. Azaleas are plants very easily managed, so that every one who possesses a small green-house may venture upon their cultivation with every prospect of success, whilst those with more extensive accommodation can insure a succession of their beautiful flowers from Christmas to May and June.

To maintain such a display, however, a goodly number of plants would be required. It should also be borne in mind that when in flower these plants will stand unharmed in drawing-room or boudoir for a long time, and therefore it will be necessary to have a selection of sizes, as well as variety, in order to produce a suitable effect in the house; when the plants used are of proper size, an Azalea in flower may be used in any place.

Azaleas stand in the first rank as exhibition plants. They are also invaluable for cutting for bouquet-making, room-decoration, or wreath-making, and as the variety of colours is so great every one can have his taste gratified. To those who cut their flowers with long stems, these plants especially recommend themselves, as they bear this with great impunity; in fact, the amount of cutting which Azaleas bear would quite destroy many plants. After flowering is past, the plants should be examined. If it is desirable to re-pot into a larger pot, this is the best time to do it. With many plants this is necessary annually, but Azaleas may be kept in the same-sized

pot for several years. The soil they thrive well in is a mixture of peat, loam, leaf-mould, and sand, using three parts of the first to one each of the latter. Drain well and pot firmly, and if it is possible to give them a little warmth, the growth will be more vigorous and rapid. At this time they should be syringed about twice in the course of the day, morning and evening being the best times to apply the shower-bath.

The original species, *A. indica*, was introduced in the early part of the present century; and although at that time considered a very fine and showy plant, it has long ago been left behind by the improved forms which have been brought into commerce by the florists, who have been most painstaking and successful in improving this flower, both in size and variety of colour. During the last few years a new feature in this family has been obtained by the hybridisers, and this is the introduction of a class of *small-growing* kinds, which flower very early, and produce small flowers, that are perfect gems for button-holes, bouquets, shoulder-sprays, and such-like purposes, when the flowers of the ordinary kinds cannot be used. At present the numbers of this section are few, but the cross-breeders are busy at work, and before long these, like their larger-flowered relations, will undoubtedly form a leading feature in the garden.

A. Altee.—Flowers very durable; beautiful deep rose, with large blotch of vermilion.

A. Argus.—Semi-double, splendid shape and substance; light salmon, with deep crimson blotch.

A. Apollo.—Very large: white, with carnation flakes and stripes.

A. Baronne de Vrire.—Enormous flowers; petals beautifully waved, snow-white, flaked with crimson, blotched with sulphur on upper petals.

A. Bernard André.—Flowers double; rosy-purple, very fine.

A. Bernard André, alba.—A close, compact habit; flowers double, pure white, very beautiful.

A. Bijou de Paris.—Pure white, striped with rosy carmine, and blotched with yellow; flowers very large; a very desirable kind.

A. Brilliant.—A late-blooming variety; flowers of good form, rich orange-scarlet.

A. Cedo Nulli.—This is generally supposed to be the nearest approach to a blue Azalea which has yet been obtained; flowers of good substance, and very rich purple.

A. Charmer—A very distinct variety; flowers bright amaranth, blotched with a deeper shade.

A. Chelsoni.—Fine form and substance; colour light orange-scarlet, blotched with purple.

A. Comet.—Bright light scarlet or flame-colour, upper petals shaded purple; very showy.

A. Comtesse de Beaufort.—Beautiful rose-colour; upper petals blotched with deep crimson.

A. Comte de Hainault.—Flowers immense; salmon-pink, upper petals well spotted with dark maroon.

A. Dr. Moore.—Flowers double; intense rose, shaded with violet; perfect form.

A. Dr. Livingstone.—Large and handsome; rich rosy-purple.

A. Dominique Vervaene.—Fine double, orange-red flowers.

A. Duc de Brabant.—Dark rose, with dark spots on the upper petals.

A. Duchesse Adelaide de Nassau.—Fiery crimson, shaded with violet; large and fine.

A. Duchess of Edinburgh.—Pure white; fine form; very useful for forcing.

A. Duke of Edinburgh.—Deep crimson, upper petals shaded purple; fine flower.

A. Eelatante.—Deep crimson, shaded with rose, densely spotted; one of the best.

A. Fascination.—Bright rose, spotted with rosy-crimson, and edged with white.

A. Flambeau.—Glowing crimson, very bright.

A. Flag of Truce.—Pure white, double and very full; one of the finest double whites.

A. François Devos.—Clear deep crimson; very double, and good shape.

A. Her Majesty.—Rosy-lilac, blotched and spotted with crimson, and bordered with white.

A. Holfordiana.—Rich rosy-crimson; very fine.

A. Hortense Vervaene.—Rosy-salmon, edged with white.

A. imbricata.—Double white; very full and double, superb flower.

A. John Gould Veitch.—Rosy-lilac, with white veins, blotched with saffron, and bordered with white; a superb flower.

A. Juliana.—Rich crimson, densely spotted.

A. La Victoire.—Bright red, beautifully spotted with crimson-maroon.

A. Louis von Baden.—Pure white; form and substance good; profuse bloomer.

A. Madame Louis de Kerchove.—Bright cerise, flaked with orange, shaded with carmine, blotched with maroon, and bordered with white; superb.

A. Madame Hardy.—Orange-scarlet, upper petals purplish-crimson; large and fine.

A. Madame van Houtte.—Pure white, flaked with rose and crimson; grand flower.

A. Madame van Eekhaut.—Flowers upwards of five inches in diameter, intensely double, with broad outer petals of good substance; perhaps the best double white yet raised.

A. Madame Ambroise Verschaffelt.—Violet-rose, flaked with crimson, and edged with white.

A. Madame Camille van Langenhoven.—Pure white,

broadly flaked with salmon and carmine, blotched with yellowish-green; very fine.

A. Madame Iris Lefebvre. — Very double, deep orange-red, flaked with dull violet.

A. Marquis of Lorne.—Beautiful orange, blotched with salmon; fine flower

A. Mdlle. Leonie van Houtte.—Pure white, streaked with rose, pale yellow in centre; fine flower.

A. Mdlle. Marie van Houtte.—Semi-double, pure white, flaked and dotted with salmon; a beautiful form.

A. Mdlle. Marie Lefebvre.—Pure white; flowers very large; form excellent.

A. Magnet.—Bright rosy-salmon, blotched with a darker shade; very large; excellent form.

A. Mars.—Orange-crimson, well spotted with vivid red; very showy.

A. Mont Blanc.—Fine double white of great substance.

A. narcissiflora. — Pure white, double; medium size; well adapted for early forcing.

A. Ne Plus Ultra.—White, mottled with salmon; large and free.

A. Perryana.—Dark orange-scarlet; good form and substance.

A. President Ambroise Verschaffelt.—Bright orange-scarlet, shaded with bluish-purple, and spotted with maroon; flowers large and good.

A. President Ghellinck de Walle.—Very double deep rose, blotched with lake, and flaked with crimson; fine flower.

A. President Vanden Hecke.—White, dotted and striped with bright crimson, centre yellow.

A. Prince of Orange. — Bright orange-scarlet, heavily spotted with crimson; good habit, very free.

A. Princess Alexandra. — Flowers large; white, streaked with rich crimson; very handsome; well adapted for early forcing.

A. Princess Alice.—Pure white; fine form and substance.

A. Princess Teck.—White, flaked with rose and salmon; fine shape and substance; very useful for early forcing.

A. Purity.—White; large; fine form and substance.

A. roseiflora.—Flowers double, like a fine Balsam; rich rosy-red; exquisite form, very dwarf; a most desirable variety. Introduced from Japan.

A. Roi des Beautés.—Double rose, bordered with white; fine flower.

A. Roi de Holland.—Vivid scarlet; large; fine form.

A. Roi des Doubles.—Rosy-carmine; very double, large; fine form; profuse bloom.

A. Souvenir de Prince Albert. — Beautiful soft rosy-peach, bordered with white; showy and fine variety.

A. Stanleyana.—Rosy-carmine, flaked with amaranth; large and handsome; fine form.

A. Stella.—Bright orange-crimson, blotched with reddish-purple; large and handsome.

A. Vesuvius.—Bright orange-scarlet, upper petals shaded purple; very brilliant.

A. virginalis.—Pure white, with wavy margins; fine flower.

A. Vivid.—Splendid scarlet; petals of fine substance; fine form, extra.

Banksia.—This genus belongs to the natural order *Proteaceæ*, and assuredly the various plants which make up the order are of the most protean forms. The late Dr. Lindley says, "Upon the whole the order is the most useless to man," nevertheless many of them bear extremely ornamental flowers, and others have equally beautiful foliage. The genus *Banksia* is named in honour of Sir Joseph Banks, who did so much for botanical science, and natural history in general, and it is rather discreditable to the present generation of gardeners that his memory is held in so little respect, for we have no hesitation in saying that one-half the plant cultivators of the present day have no knowledge of any of the species. The early botanists did all in their power to honour his name, and no less than three authors have made a genus *Banksia;* two of these, however, have been suppressed, one being merged in the genus *Costus*, and the other in *Pimelia.* The present one established by the son of the immortal Linnæus remains, and therefore we introduce it here, notwithstanding they have come to be looked upon by many gardeners of the present age as old-world plants, entirely beneath their notice.

In the early part of the present century, Banksias, and other members of the order, were much prized by gardeners and amateurs, for their elegant leaves and their beautiful and singular flowers. They are plants of slow growth; and in these days of steam and electricity, they probably cannot be waited for, gardeners preferring such plants as will make a large specimen in a short time, to the exclusion of many beautiful plants that formally were the delight of all beholders.

Banksias are, for the most part, low-growing shrubs, although some few species do attain to the dimensions of trees. As before mentioned, they are of slow growth, and require considerable care to cultivate them successfully; they are plants that dislike frequent re-potting, and may remain in the same pot for several years with advantage. The soil best adapted for their requirements is good yellow loam, not too heavy, with a liberal addition of sharp sand; the drainage above all things must be kept open and free, and great care must be exercised in watering.

Cuttings do not strike freely, and propagation is best effected by seeds.

After flowering, Banksias produce large woody cones, in which their seeds are enclosed, many of them being very grotesque in form.

B. australis.—A compact-growing plant, seldom exceeding six feet in height, with small dark green leaves, which are silvery-white beneath; flowers green.

B. compar.—This is considered by some a variety only of *B. integrifolia;* it differs, however, in having the margins of its leaves serrated; they are dark green above, and silvery-white beneath; flowers straw-colour.

B. Cunninghamii.—A handsome dwarf species, with narrow dark green leaves, which are hoary beneath, and furnished at the margins with a few spines; flowers pale yellow, very showy, on large oblong heads.

B. dryandroides.—A charming small-growing plant with pinnate leaves, resembling some of the small-growing simple-leaved Polypodiums; lobes triangular, dark green above, ferruginous beneath; flowers pale yellow.

B. foliosa.—Leaves oblong, deep green above, clothed with a greyish tomentum on the under side, finely serrated on the margins; flowers greenish-yellow; a highly ornamental plant.

B. Hookerii.—A noble plant, with broad and deeply-lobed pinnatifid leaves, dark green above,

Roi des Doubles. President A. Verschaffelt.

AZALEAS.

BIGNONIA VENUSTA.

grey beneath, veins prominent; flowers reddish-brown.

B. latifolia.—As a young plant, this is very beautiful; it attains with age the dimensions of a large tree; the leaves are broadly lanceolate, narrowest at the base, dark green on the upper side, clothed with a grey tomentum below, midrib and principal veins very prominent, furnished with a thick covering of rufous hairs; flowers greenish-yellow.

B. serrata.—A free-growing species, which in its native country attains considerable size; leaves some

six inches long, toothed at the edges, deep green; flowers yellow.

B. Solandri.—A fine bold kind, with broad deeply-lobed leaves, upper side dark green, silvery-white beneath; flowers scarlet.

B. speciosa is one of the most charming species in the family; leaves six or more inches long, divided to the midrib into semi-circular lobes; deep green, under side silvery-white, the young growths and midribs clothed with a chestnut-brown tomentum; flowers yellow.

Beaufortia.—Handsome evergreen flowering shrubs, belonging to the Myrtle family, all natives of Australia. They should be potted in a mixture of three parts fibrous peat and one of sandy loam. Ordinary green-house treatment suits them.

B. decussata.—Leaves opposite, ovate, dark green; the flowers spring from the axils of the leaves near the points of the shoots; bright scarlet, very showy. May and June.

B. purpurea.—Leaves at base narrowly lance-shaped, becoming cordate near the points where the globose heads of purple flowers are produced. Summer months.

B. splendens.—Leaves small, oval, light green; flowers bright scarlet, style much exserted. Summer months.

Bignonia.—A genus of handsome climbing plants, bearing large panicles of irregular bell-shaped flowers. They are admirably adapted for covering pillars and rafters in green-house or conservatory when planted out, but under pot-culture they are seldom satisfactory.

Plant them in two parts good rich loam and one part peat and sand.

B. Chamberlaynii produces large, trumpet-shaped, rich yellow flowers during the whole of summer. Brazil.

B. speciosa is a beautiful companion to the preceding, its large clusters of lilac flowers forming a nice contrast. Spring months. Uruguay.

B. venusta.—This plant should find a place in every green-house, its charming large deep crimson flowers rendering it most effective. It blooms nearly the whole summer and autumn. Brazil.

Boronia.—These are pretty green-house shrubs, with opposite pinnate leaves, more or less showy, producing their pink and white flowers in spring and early summer; they should be potted in good peat and a little turfy loam in the proportion of two to one, to which add a little sand. Boronias naturally form bushy shrubs, but if not looked after are apt to get bare at the bottom, and present an unsightly appearance; therefore, after flowering, all the shoots should be cut back, in order to encourage lateral growths, which, if not producing the largest plants in the shortest time, produces much the best specimens. Boronias require strict attention in the matter of water; they like a copious supply, but at the same time the drainage must be free. They also require thorough ventilation, but avoid cutting winds; again, they should not be in the open air exposed to the sun during summer; it causes the foliage to turn brown, which remains as a permanent disfigurement.

B. Drummondii.—Leaves pinnate, bright green; producing in abundance its charmy rosy-pink flowers in April and May.

B. Drummondii alba.—As its name implies, the flowers of this variety are white.

B. elatior.—One of the freest-growing species, and a charming plant when in bloom; leaves pinnate, dark green; flowers large, numerous, deep rosy-purple. New Holland.

B. heterophylla, the most recent addition to this genus, and perhaps the most beautiful. It is an erect shrub, producing numerous slender branches; the leaves are of various shapes, simple or trifoliate, but always narrow. The flowers are globose, pendent, freely produced, and bright carmine-scarlet in colour, very fragrant. Spring months. Swan River district, Western Australia.

B. megastigma.—A very slender-growing plant, with line-like divisions to its pinnate leaves; flowers freely produced, drooping, the outside dull purple, greenish-yellow inside. This is by no means showy when in flower, yet no green-house should be without the plant on account of the delicious violet-like fragrance which it diffuses. It flowers during spring and early summer. King George's Sound, 1868.

B. pinnata.—Flowers pink, with a fragrance resembling Hawthorn; produced in April and May. Fort Jackson, 1794.

B. serrulata.—This species differs from all the others in having simple and not pinnate leaves; they are somewhat trapeziform in shape, and bright green in colour; flowers cherry-red, with a fragrance like that of the Rose. May and June. New South Wales, 1816.

B. tetrandra.—This plant bears some resemblance to *B. pinnata;* it is, however, a smaller grower; flowers pink. March to May. Swan River, 1824.

Bossiœa.—A genus of Pea-flowered Australian shrubs, of great beauty when in bloom; they require careful attention in the matter of water, and should be potted in about three parts peat and one of loam, to which add sufficient sand to make the whole feel sharp to the hand.

B. cordifolia.—A compact-growing species, the

branches densely clothed with dark green cordate leaves; flowers yellow and purple. May and June. New South Wales, 1824.

B. disticha.—Leaves somewhat ovate, dark green; flowers yellow and red. March to May. Swan River, 1840.

B. tenuicaulis.—An extremely handsome species, and profuse bloomer; stems slender; leaves ovate acute; flowers yellow, streaked with purple; produced in March and April. Tasmania, 1836.

Bouvardia.—This genus contains some of the most useful plants that can be grown; they are compact in growth and very free-flowering. The flowers are much prized for bouquets, shoulder-sprays, button-holes, or indeed any purpose to which elegant and fragrant blossoms can be put.

Boronia megastigma.

The species are natives of Mexico, but some of the best varieties have been obtained by cross-breeding in English and American gardens. Whether these are stove or green-house plants is rather a disputed point amongst the members of the horticultural world, some favouring one side, and some the other. However, as they thrive admirably in the green-house, and are only put in stove-heat in autumn, in order to force them into bloom through the winter months, which is the time the greatest demand occurs for such flowers, we have included them with the green-house plants; at the same time, it is quite true they enjoy a little more heat in winter than is given to such plants as Heaths.

Bouvardias may be grown into good-sized plants in a single season, and as young plants produce greater numbers and finer-quality flowers than old ones, it is much the better system to strike cuttings every spring. The old plants, after flowering, will, if cut back, soon begin to make lateral shoots, which should be taken off during March and April, and inserted round the sides of cutting-pots, filled with sandy peat, with a cover of sharp sand at top, and kept in a moist, close atmosphere until rooted, when they must be potted singly into small pots. After root-action commences, pinch out the point of the shoot in order to produce side branches; these, after having made about two joints, should again be pinched, and so on, until a good bushy plant is obtained. As the plants increase in size, and the pots get filled with roots, it will be necessary to shift into larger pots, and by the end of July or beginning of August they will be well established. During all this time the plants have been growing in a rather warmer and moister atmosphere than an ordinary green-house, in order to induce rapid growth, but at about this time remove them into a cool house or frame, where they can have free ventilation. This will mature the growths, and cause them to set their flower-buds freely. Towards the end of September again place them in a house where heat is at command, if a period of wet or cold weather should set in; and as flowers are likely to be wanted, from time to time remove a batch into the stove, in order to keep a succession of flowers during the winter months. This treatment may be said to favour the stove more than the green-house, but it must be borne in mind that old plants which may not be wanted in bloom so early, can be grown entirely in

the cold house, and even planted out in cold frames; they make fine specimens, and may be lifted and potted up in autumn. For soil, use a mixture composed of peat, loam, and leaf-soil, in about equal parts, a portion of sharp sand being added to keep the whole porous; drain well, and supply liberally with water. Keep the syringe going frequently amongst them to prevent the ravages of red spider or green fly. The following are amongst the most desirable kinds:—

Alba-odorata.—Flowers white, very fragrant.

Augustifolia.—Bright scarlet.

Brilliant.—Fiery red.

Elegans.—Brilliant scarlet.

Delicata.—Salmon-red and pink.

Hogarth.—Brilliant carmine.

Humboldtii corymbifera.—Pure white, the purest and largest variety, but the plant is, unfortunately, rather a shy bloomer.

Jasminiflora.—Pure white, large flowers.

President Garfield.—Double pink, very fine.

Alfred Neuner.—Double white, exquisite.

Vreelandii.—Pure white, very fine, a most useful variety.

Bouvardia (Alfred Neuner).

Brugmansia. — The plants comprising this genus were formerly included with Daturas. They belong to the order *Solanaceæ*, and well deserve attention when space will allow of their cultivation. In growing a specimen of any of the species here enumerated, the best system is to confine them to a single stem, until they attain a height of three or four feet; then the point of the shoot should be pinched out, to encourage lateral growths, and these again, when sufficiently long, must be subjected to the same treatment, until a good-shaped head is obtained. Brugmansias are coarse-feeding plants, and should be potted in rich soil, say about equal parts of loam, leaf-mould, and well-decomposed manure. After flowering, which will be towards autumn, the plants may be pruned in hard; this will render them less cumbersome; and during winter very little water should be given.

B. Knightii.—Flowers large, drooping, double, and pure white; it blooms in August and September.

B. lutea.—An autumn-flowering species, attaining

a height of about twenty feet; it resembles *B. suaveolens* in its fragrance, but differs in having yellow flowers. August and September. South America.

B. sanguinea.—Attains the height of eighteen to twenty feet, and is a grand plant for conservatory decoration; the flowers are trumpet-shaped, about eight inches long, with spreading limb; the tube is orange-yellow, and the limb deep scarlet. Peru, 1833.

B. suaveolens.—This plant attains about the same height as the last-named species, but all these will commence blooming when much smaller, the size given here being that to which the plant attains when mature. Flowers drooping, four to six inches long; limb spreading, pure white, the tube being tinged with yellow; the flowers are very fragrant. August to September. Peru, 1733.

Burtonia.—Pea-flowered plants, with Heath-like leaves, bearing very freely rather large, highly-coloured flowers towards the ends of the branches. They are by no means difficult to manage, and should be potted in light loam and peat in about equal parts, with the addition of a little sand.

All are natives of Western Australia; there are only some nine or ten species known, of which the following are the most attractive :—

B. conferta.—Purple and violet. June and July.

B. pulchella.—Purple. April and May.

B. scabra.—Yellow. May and June.

B. villosa.—Purple. May and June.

Callistachys.—This genus includes a few very handsome Pea-flowered plants. The name, which signifies "beautiful spike," is still applicable, even at the present day, when we have such a profusion of grand flowers for the decoration of green-house and conservatory.

The species of *Callistachys* are for the most part natives of the Swan River district of Australia. All are very free growers and profuse bloomers, and thrive well when potted in a mixture of peat and loam in about equal parts, with a little sand added.

C. lanceolata.—Leaves narrowly lanceolate, clothed with numerous silky hairs; flowers in terminal racemes, large, and rich golden-yellow. Summer months.

C. linearis.—Leaves long and narrow; flowers on terminal spikes; deep purple. October.

C. longifolia.—A handsome species, with rich yellow and purple flowers. June and July.

Callistemon.—Handsome plants, belonging to the Myrtle family. They are remarkable for their beauty, even when not in flower, as in many instances the leaves when young are stained with a rich deep vinous red or crimson. There are many species of this genus. One species, *C. ellipticum*, a native of New Zealand, attains a great height, and measures several feet in diameter; the wood is very hard, and takes a beautiful polish, resembling rose-wood. Soil same as for *Callistachys*. They may be obtained either from seeds or cuttings; the latter method is much to be preferred, as seedlings frequently grow to a large size without flowering, whilst quite young plants from cuttings will be laden with their beautiful bottle-brush-like flowers.

C. lanceolatum.—A lovely plant with small dark green leaves; flowers axillary, forming dense spikes, which are nearly terminal; rich reddish-crimson in colour. June. Australia.

C. lophanthum.—Leaves small, hairy when young; flowers in dense spikes near the points of all the shoots; pale yellow. Summer months. Australia.

C. viridiflorum.—Leaves narrow, lanceolate, small, dark green; flowers in a dense terminal spike; stamens much exserted; colour, yellowish-green. Summer months. Australia.

SUBURBAN GARDENING.

By James Hudson.

DETACHED VILLA GARDENS.

THE space allotted for the garden of a detached villa is very often not any larger than that connected with semi-detached houses; but by reason of the house standing entirely surrounded by its own grounds, it affords more scope for making a good effect. We have repeatedly seen very picturesque arrangements of the garden ground in connection with detached villas. There is also the advantage of more seclusion and privacy in the garden, which cannot possibly be the case with semi-detached houses or with terraces. This is a great boon undoubtedly to the occupants, causing the garden frequently to be far more enjoyable than would otherwise be the case.

Detached villas carry us perhaps further into the country, but not much; for although we are within sight of the Albert Hall and the Crystal Palace in clear weather, we have several such around us. As we have previously said, in size these may not exceed those of the plans we have given in a preceding article, or even be so large, yet from their having an entire surrounding of the house, they are of necessity more nearly square in shape; this addition in the breadth will give better opportunities for producing a good effect in the design. Long narrow gardens, even at the best, are difficult to arrange in a pleasing manner; but where they are more proportionate, far better designs can be carried out.

Fruit-trees. — Many remarks that we have made in previous articles apply with equal force to the subject now under consideration, and *vice versâ*. In this case, however, we may give rather more prominence to the kitchen and fruit garden, thus combining more of practical utility with enjoyment, or, in other words, pleasure and profit combined. The culture of fruits is not an easy matter when in close proximity to manufacturing towns or large cities. There are a few exceptions, where the site is specially favourable or the soil well suited to their culture; but taken on the whole, the proceeds are generally at a minimum rate. This should not deter those who are more fortunate in being farther removed from these detracting influences, from making fruit-culture to a moderate extent a part of their enjoyment and recreation. Vegetables, too, could have a greater space allotted to their culture with advantage, manure when required for the latter, or the assistance of manual labour, being obtainable at a less cost.

Take, for instance, standards of Morello Cherries, or other varieties if preferred, but more especially the "Morello," because it does not become of large dimensions before arriving at a fruiting condition. It could also be trained against one of the walls of the house, having a north-west or north-east aspect. Standard Apples, again, selected from those kinds of moderate growth, would have a very pretty effect, either among shrubs of an evergreen character, or planted on a grass-plot. Why fruit-trees are not thus utilised in combination with flowering shrubs and trees of merely ornamental character, we do not know; they have the double advantage of affording to the possessor the prospect of a substantial return, whilst in point of floral beauty they are equal to, and even surpass, many things that are grown merely for the flowers they produce. Again, they will have a beautiful appearance when laden with their respective crops; and this in itself is, we think, sufficient to recommend the more extended cultivation of fruit-trees in association with those of ornamental character only.

Unsuitable Subjects.—One important observation, among many others, should be regarded by every one who has under contemplation the planting of new gardens or the re-arrangement of older ones, and that is, to study well the kinds of trees, shrubs, and fruits which thrive best in or near the same locality. Indications will be apparent to any close observer as to what are the most suitable things to select, and also perhaps what to avoid.

Thus, for instance, hardly any of the Fir family are found even in a medium condition of health in the neighbourhood of the metropolis, and that such should thrive when newly planted in the dirt-poisoned, fire and gas-dried atmosphere of large cities is more than can be reasonably expected. They linger out a miserable existence for a few years, and then succumb to the inevitable. We have had to remove fine specimens of from twenty to thirty years' growth even, from the gradual extension of suburban London, more than from any other assignable cause.

Among these were a Douglas Fir (*Abies Douglasii*), which in the pure country air thrives exceedingly well, as may be seen by the grand specimens at Heckfield, Dropmore, and elsewhere. The *Wellington gigantea*, so well known and deservedly admired when in robust health, has with us been a miserable failure. In its earlier stages of growth, one specimen did fairly well; but as it was brought more under the deleterious influences just adverted to, it succumbed and became such an unsightly object that it had to be removed. The Spanish Silver Fir (*Picea pinsapo*), which, for small gardens, would be a most appropriate species to plant, is yet another instance in which failure has occurred. This is a magnificent tree when well developed, but as it takes many years to arrive at large dimensions, it may be safely planted in small gardens in the country. Our largest specimen became at last almost completely denuded of its foliage, and each succeeding growth it produced was weaker than the last, removal having at last to be resorted to.

It is not necessary to mention here any more cases, but a list of what to avoid will be given later on. Suffice it to say, there are a few exceptions which we have found in members of the Fir-tree family to do fairly well. One of the hardiest and best of these is the Austrian Pine (*Pinus Austriaca*), which at present resists the drawbacks to the culture of more tender species, and retains the deep green colour of its foliage very well. The Himalayan Pine (*Pinus excelsa*), with its leaves of a glaucous bluish-green, is another notable exception, and a fine object when well grown, being a striking contrast to the afore-named species (*P. Austriaca*). The Swiss Stone Pine (*Pinus cembra*), of slow growth, erect yet compact in habit, is another species that thrives well in the vicinity of the metropolis. This species is well adapted for gardens of limited extent. The *Retinosporas*, from Japan, and of comparatively recent introduction, appear to do very well, especially the more robust varieties. Further instances will likewise be treated upon hereafter.

Any close observers of landscape scenery may, however, note for themselves the absence of all of the commoner species of the Fir tribe, at least in anything like a satisfactory condition of growth, as they near our large towns and cities; and probably

the want of such large evergreen trees is the cause of more stunted growth in many dwarfer genera of ornamental shrubs and trees than would otherwise be the case.

Acclimatised Plants.—We consider it an excellent plan, in selecting the necessary trees and shrubs wherewith to plant suburban gardens, to procure them at the *nearest* nursery grounds where good choice is to be had. This will be the more likely to insure future success than by having recourse to sending to a long distance for them. If they have been grown from their earliest stages within a fair distance of the garden in which they are to be planted, and that too in a similar kind of soil, the future well-being of each and all will be the more easily attained. This is all the more important in small gardens where no experienced gardener is employed constantly to see to the necessary requirements of the occupants. Where such is the case, the soil, &c., can be modified to a certain extent by those in charge; this, however, would hardly come under the head of suburban gardening; and all trees and shrubs will be found to succeed far better if these hints are carried out in practice; indeed, it must necessarily be the case, provided the purchases are in good health when obtained, they being in a measure comparatively acclimatised to the locality.

Recently we watched with considerable interest some well-grown coniferous plants that had been just planted in the front of a detached villa garden. They were well-grown stock, in every way healthy, but we could readily discern by their appearance that they had been brought from a considerable distance, and off another description of soil to that in which they were then growing. Gradually they began to assume a sickly hue, and by degrees the lower branches died off; later on, some of them from their ungainly appearance were removed. Not one is now in a satisfactory condition of health, though apparently they were fairly well planted, and attention given to having the soil around each mulched after planting. This, and similar instances, are enough to discourage any one not practically acquainted with the cause of failure, making him feel as if it were quite impossible to succeed in his desires. But the stock from a suburban nursery, or within a near radius of the neighbourhood of large towns and cities, *though not in many cases looking so robust and thriving*, will eventually give the greater amount of satisfaction to the purchaser. Suburban nurserymen are practically acquainted with the stock likely to succeed in their respective localities, and a glance through their grounds will oftentimes be a useful aid in making any future selections. Those things that are most in request will be found in far larger numbers amongst every genus of plants, and this may fairly be taken as a guide in making choice for the garden.

Whilst on the subject of purchasing trees and shrubs, as well as in the case of plants in pots, it will not in every case be the cheaper way to procure those that are offered at unusually low prices. We advise purchases certainly to be made as cheaply as possible consistent with a good article; but to buy any plant just because it is cheap is a great mistake, without having closely inspected the plant beforehand. Shrubs, &c., are at times offered at tempting prices; these may possibly have been grown in nursery beds or quarters for some seasons without removal. In this case their roots and branches will have become much interlaced among each other. When removal is effected the roots consequently become injured, and the branches from want of support are unable to retain their proper position. Such stock as this is also much drawn up, and quite devoid of the sturdy compact growth which is the characteristic of well-grown nursery plants. In such instances, by reason of less expenditure in cultivation, the plants can of course be offered more cheaply; but in the long run they will not be nearly so likely to give even a fair amount of satisfaction as in the case of such nursery stock as may have been subjected to a proper course of culture in its various stages of growth.

Times for Planting and Removal.—The autumnal months of September, October, and the early part of November are generally accepted as the most suitable time of the year for the removal and transplanting of trees and shrubs. The first half of that period is preferable to the latter, as it affords the newly-planted stock better opportunity of becoming settled down in their new quarters before the advent of a probable severe winter. We therefore strongly urge any contemplated alteration or improvement to be taken in hand without any delay when that season of the year arrives. Better choice, too, of the requisite kinds of trees and shrubs will be afforded; the best of each class invariably finding the most ready market. There is another disadvantage in deferring the planting operations till late in the season, which is occasioned by the removal from their growing quarters *en masse* in prospect of future demands, and also to clear the ground for early preparation for re-planting; in such cases the stock for sale is generally *heeled in* close together, and if allowed to remain in that manner for long, the roots must necessarily suffer in consequence, the more so if the autumnal rainfall is less than usual. Failure is oftentimes occasioned in

our opinion by this interval of time, which ought not to be allowed if at all preventible. Hollies we have found, from several years' experience, to remove in far better condition during the months of May and June than at any other period of the year. We have transplanted numbers during those months, and have invariably found them to succeed. When re-planted in the late autumn and winter months they are very liable to shed the greater portion of their foliage; this defect in a large garden is bad enough, but in one of limited extent it is rendered even more so, through all the occupants of the garden coming under closer observation.

In small plots of garden ground another essential point to be studied is the avoidance of a frequent repetition of the same individual kind of shrub. There are an abundance of good and useful kinds from which selection may be made to give as great a diversity as possible.

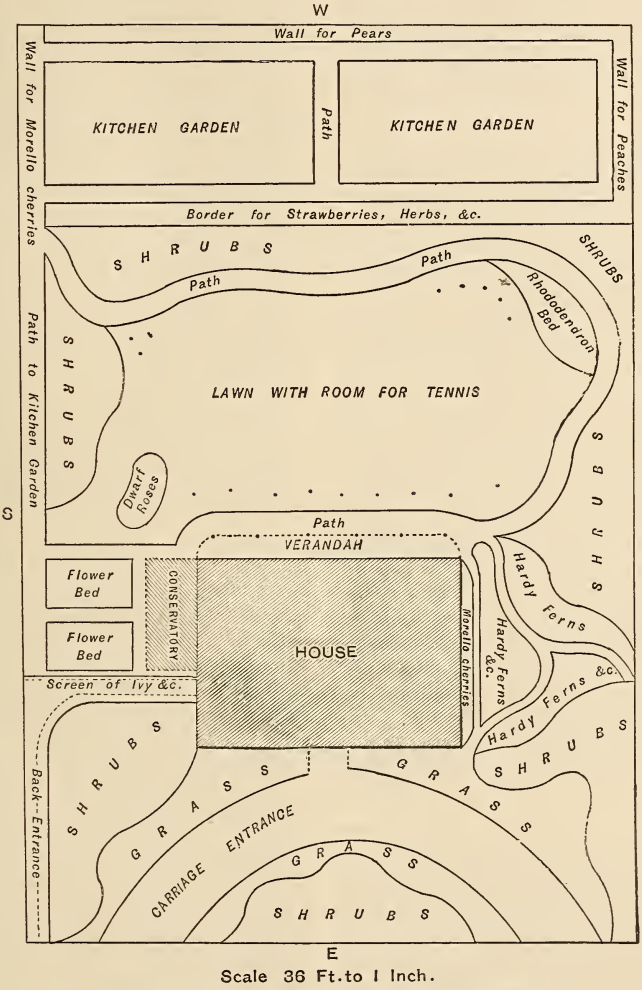
Hedges.—In the event of any sub-division in the grounds being necessary, and this being effected by a hedge, we would in every case advise the choice being made from those shrubs of an evergreen character. Hollies, Privet (evergreen kinds), Euonymus, Portugal Laurel, and Yews (English), are all good selections. Instead, however, of following the generally adopted plan of clipping the same with shears every season, we would advise the requisite pruning to be done with a knife until the hedge reaches to something like its proper dimensions. In this manner the desired object will be more quickly attained, the stronger shoots not, by that process, having to share the same fate as the weaker ones, which is next to unavoidable when the hedge is gone over indiscriminately with a pair of garden shears. The side-growths will, as a matter of course, need pruning rather more closely in order to avoid an undue amount of garden-space being taken up by the hedge itself. In order, oftentimes, to obtain an immediate effect, the shrubs used in the formation of a hedge are planted far too closely. For the time being this may present a better appearance, but as thinning out afterwards, when becoming too thick, is not an easy matter with shrubs used in the formation of hedges, it is far preferable to plant at a moderate distance from each other in the first instance, and wait with patience for the desired result, which will eventually be far more satisfactory. When crowded together, the natural results of decrepitude and decay will sooner or later supervene, long ere such would be the case if operations were proceeded with in a more practical manner at the outset. Patching up in the case of failure in some spots will have to be performed in order to preserve the general appearance, and this even at the best is not an easy matter. During long periods of drought, a thickly-planted hedge will also suffer much in some soils from lack of moisture. At such times there are always plenty of subjects needing more immediate attention, with the result that commoner things have to be passed over in many instances, unless an unlimited supply of water is at hand.

The plan of laying up a narrow ridge of soil whereon to plant the material for forming a hedge should not be practised where it is necessary to gain any height at the outset; the better way will be to gradually rise to the required height by easy slopes. Other shrubs or plants of an evergreen character should not be planted too closely to any hedge, but ample space allowed for the growth of both, and likewise for a good circulation of air between them. When too closely planted one or the other, or perhaps both alike, will suffer if removal is not seen to in time. In all kinds of shrub and tree planting a considerable amount of *foresight* is requisite with regard to their future appearance. Some strong-growing kind may gain an undue amount of preponderance in such cases, after a season or two; then the pruning-knife should be used freely, and some of the stronger roots severed with a spade. Rather than let a common plant or shrub that is of no material value outgrow and deprive choicer things of their necessary space for growth and development, it will be far better to remove the same entirely.

Planning.—The design in Fig. 3 will be found fairly proportionate in arrangement, the space allotted to each subject being regulated in such a way as not to allow of any one essential of a garden about the size of that given predominating above the rest. At the first glance, perhaps, the space marked out for shrubs would appear to be somewhat in excess, taking into consideration the space at disposal. When, however, our suggestions of intermixing a few standard fruit-trees among the other deciduous and evergreen trees and shrubs are carried out, this will greatly modify any such apparently undue extent of ground. The margins of the shrubs can also be most suitably planted with hardy herbaceous and other dwarf flowering plants, allowing a broader margin for such where the width marked out is proportionately wide. In a small garden we would prefer to allow for these necessaries in this way, far before cutting up the open spaces into flower-beds, as may very frequently be seen, even where the garden-space is most limited in extent. The lawn will then appear of greater dimensions than it really is, and more facility will be offered for the arrangement of such garden recreations and amusements as lawn tennis, &c., for

which we have allowed sufficient ground, provided guard-nets are used at the margins where coming somewhat too close up to the borders of the shrubs. In the event of no such games being required, we would advise the addition of a few beds of the choicer Rhododendrons and other dwarf, or comparatively dwarf, permanent kind of plants, in preference to marking out any set design of flower-beds for tender plants, which at the best only last in beauty for a few months. Plants of a permanent character, although involving a trifling increase in outlay at the first, will soon recoup themselves both in the amount of labour expended on them, and in the saving effected in the non-purchase of tender bedding plants for filling flower-beds during the summer months.

We have given the plan as presenting an entrance front facing the *east*, with sufficient allowance for a carriage-drive to the front door, with gates for ingress and egress, which will be found far more convenient than one gate only for both purposes, with the consequent occupation of a sufficient space for the turning round of any conveyance that may enter. On this front we would advise a few tall trees or shrubs opposite the front door, to screen the same from the road. A Copper Beech would look well as a central plant if flanked by evergreens, and one or two Laburnums would present a beautiful contrast to the Beech when they are in flower. A narrow margin next the grass, and in front of the shrubs, might be planted with the hardiest of flowering plants, such as the common white Pink, London Pride, or similar dwarf plants of a permanent character. On the north-east side the space allotted for shrubs should be somewhat elevated ground, to act as a screen from east winds to the portion marked out for hardy ferns and rock plants. We have made a rather prominent feature of these for that spot, where they would succeed well with a moderate amount of attention, being shaded by the house from the noonday sun, and partially protected on the north also from cold weather by the spaces shown as for shrubs in that direction. Against the north wall of the building we show a narrow border to be planted with Morello Cherries, in which position they ought to succeed very well. On the south-east side of the house we have marked off a rather large space for shrubs, the intention being to protect the east end of the small conservatory and the flower-beds from cold winds, as well as to shut off the back entrance to the house itself as much as possible; this piece of ground also would be all the better in appearance if raised above the surrounding



Scale 36 Ft. to 1 Inch.

Fig. 3.—Plan of Garden for Detached Residence.

level. By performing this operation in a careful manner as advised in a previous page, the shrubs will succeed equally well, and a gain in height will be secured at the outset. As this is a broader plantation of shrubs, a corresponding margin for flowering subjects of a dwarf character could be allowed for in sufficient number to make it gay and effective. We have allowed for a screen of Ivy next the conservatory and flower-beds, to shut the same off from the back entrance when viewed from a westerly standpoint.

The small building shown as a conservatory could be heated by hot-water pipes connected with the kitchen boiler, or by a gas-stove. On no account would we allow an oil-stove to be used in the structure itself, in order to exclude frost and maintain the necessary temperature. These are always doubtful expedients, and not to be compared to the hot-water system of the present day. A vine or two would be suitable for the roof of this glass structure, if only to impart a shade during the summer months, and an incentive would thus be given to produce at least a few grapes. We hope in the next article to treat more fully on what to grow, and the easiest way of management, for a small glass-house such as this.

In front of the conservatory are shown two spaces marked off for flower-beds. These would be suitable for summer bedding plants, to be followed by early-flowering Hyacinths and Tulips, with other popular flower-roots that could be moved with facility by the middle of the following May; or they could be planted with Wallflowers, Pansies, Forget-me-nots, Daisies, Primroses, or Polyanthus. If intermixed with each other they would look very well, and so, perhaps, be preferable for a small garden. These could all be removed and planted in a corner of the kitchen garden till required again the following autumn, with the exception of such as are annually raised from seed.

Verandah.—On the south front of the house we have shown a verandah. This would be a charming addition to the garden or secluded side of the building, and we often wonder why such additions are not more frequently seen, for when well clothed and festooned with suitable climbers, a verandah is one of the most attractive sights in a small garden, imparting a pleasing appearance, whether viewed from the interior of the dwelling, or seen from the exterior of the same when in the grounds. A bed suited for dwarf Roses is shown near the conservatory, and some dots on the lawn denote standards of the same flower. A spot is shown also at the opposite side of the house to that occupied by the bed of dwarf Roses, that we should consider a good position for a specimen of Pampas grass. The shrubs on the southern side of the garden need not be very tall, unless to hide any objectionable object outside the boundary; those, too, that face the house, and adjoining the kitchen garden, should be chosen with a view of but few of them reaching to any very great height. At the back of these we would plant a hedge of evergreen Privet as a boundary to the kitchen garden. A bed is marked out in the north-west corner of the lawn for Rhododendrons, in which position they would present a good appearance when in flower. If the lawn, however, is not required for tennis, this bed could be extended to twice the size, with a margin for Lilies and kindred subjects that would thrive well among the Rhododendrons. These arrangements, chosen for the aspects given on the plan, could all be modified to suit other cases, where the ground does not face the same quarters of the compass, bearing in mind that the greatest amount of protection is invariably required from the northern and easterly winds, and thus making arrangements for the better health of the tenderer occupants of the garden.

This is a most essential piece of advice, that should not in any case be overlooked, or deemed of no importance or consideration. Numbers of instances could be cited by us, and many observant readers will of themselves easily discern cases of want of practical experience in this direction, which might with ease have been avoided at the outset. The need of sound advice in this respect by those who are practically unacquainted with the requirements of plants is obvious, in order to avoid or lessen any future failure. The work in connection with small gardens is oftentimes performed by hands that have not the slightest knowledge of the needs of plant-life; in such cases one cannot much wonder at failures occurring in numbers of instances. Small gardens, too, are planted as soon as the building operations are complete, in order to facilitate the letting of the house, but without any regard to the future well-being of the different subjects that are used. In all our suburbs there are gardeners who understand this kind of work, and the practical man will soon be readily discernible from the novice, although his advice and experience may at first sight appear the more expensive of the two.

With respect to the space allotted as a small kitchen garden, we will first comment shortly on the arrangement, and then enter more fully into the culture of the easier-grown amongst fruits and vegetables.

Kitchen Garden.— The portion of ground that is marked out for a small kitchen garden will at once be discerned to be of rectangular formation. This will be found by far the best arrange-

ment even in small gardens, where fruits, flowers, and vegetables are not all intermixed with each other, and this latter practice should by all possible means be avoided. It will be far more productive of good effect to embrace the flowers and ornamental trees and shrubs in one arrangement (with the exception, as previously advised, of intermixing fruit-trees with the shrubs), and that within view of the house itself. In this manner, the best possible piece of ground for a kitchen garden is that part which is the farthest removed from the dwelling, though convenience of access to the produce often causes this arrangement to be reversed. When this plan is carried out, the formation as shown will be more readily obtainable. The ground operations and the allotted portions devoted to the culture of each given subject can be more easily arranged, and with better effect, in such a case as that now brought under consideration. Every square yard of ground in such a plan can and should be made productive of the best possible results in the most economical manner consistent with good cultivation. In such small plots it is far easier to attain to a greater degree of cleanliness and freedom from weeds than in larger gardens, where it is not so probable that every part will come under the immediate eye of the occupier or owner, as the case may be.

Maintenance.—One little piece of advice at this point might not be inappropriate, in relation to the sizes of gardens and the corresponding increase of expenditure to maintain them in good condition throughout. When any particular residence and grounds are under contemplation for either hire or purchase, it is best to consider well beforehand the probable *cost of maintenance* in a good general state of cultivation. Should the expense relative thereto eventually exceed the anticipations, the result will generally follow of an inferior condition of culture throughout, or in one portion being very much neglected. As far as the garden is concerned, it would be much better to keep clear of such places entirely, for if the space cannot be kept in a tolerably good condition, it will soon become an eyesore to any one who really loves a garden and good culture therein. The result will inevitably follow of the garden becoming a burden rather than a pleasure. It will be found a far greater source of enjoyment to maintain a *small* garden in a good state of culture, than a larger one partially neglected, and thus affording an inroad for weeds and other noxious deterrents to the occupants of the same.

Fruit.—Reverting to our plan, it will be seen at once that we have allowed for fruit-trees on each of the three walls. The portion that faces about south would be most appropriate for Peaches, Nectarines, or Apricots, either of the two former being preferable to the latter, which is more liable to canker in its branches. Should neither of these fruits be approved of, no better place could be chosen for Tomatoes, which are now becoming so deservedly popular and in much request, as well as being amenable to a simple course of culture. The opposite piece of wall facing to the north would form a good position for Morello Cherries or Red Currants. In the case of the latter being chosen, the plants should be trained in candelabra or perpendicular style, as being at once the best and simplest method. The longer stretch of wall will afford an excellent place for Pear-trees, than which we do not think anything better could be chosen for that aspect, as facing towards the east. Plum-trees might certainly be planted, especially the Victoria Plum, but the probable yield would not equal that from the Pears. In the preparation of the borders for these fruit-trees on either portion of the wall, allowance for them should be made prior to the path being laid down, so that every inducement may be given to the extension of the roots in each case beyond the limited extent between the walk and the wall. It will be better to have only a thinly-made path, than to endanger the root-extension by deeply excavating the soil to properly prepare a sound foundation. As a marginal edging to these and all other kitchen garden borders and walks, nothing will surpass a stoutly-made pattern of terra-cotta edging tiles, that afford but scant refuge for snails or slugs, which will most surely prey upon the tender and succulent crops. Box edging is not to be recommended, being more liable to injury, and requiring far more attention to keep it in order. (See remarks on Edgings, p. 193.)

Facing to the west will be found a fairly good border for Strawberries, and of greater width than the other three next to the walls. The protection of the hedge will act as a screen from the easterly winds, but it should not be allowed to reach to any excessive dimensions, either in height or thickness, or the surrounding ground would become impoverished thereby. Between the hedge and the Strawberries, or any other chosen crop, a line should be occasionally stretched from end to end, and a spade thrust deeply down, in order to sever the roots from the hedge-plants, and prevent them extending too far into the soil of the border. For if the latter is maintained in good condition with dressings of manure, every inducement will be offered for the shrubs to appropriate the same to *their* benefit, which would not be desirable nor necessary.

The two central plots could be arranged for vege-

table culture entirely, or a margin be allowed next the paths and around each plot for the culture of Gooseberries, Currants, and Raspberries; a narrow border would suffice for these bush-fruits, three feet in width would be ample. All the remainder of the ground could be cultivated close up to these, or a very narrow path allowed for, but we should not deem it necessary in such small plots of ground to make any such allowance. We would advise the margin around one piece to be planted alternately with Currants and Raspberries, and the other with Gooseberries and Raspberries, allowing about four feet from plant to plant. Planted near the walk, these fruits would be easy of access, and would not when arranged in this manner be so liable to depredations from birds, not nearly the amount of refuge being afforded them when disturbed. By this method, too, there would be a decided gain in the general appearance, as well as every inch of ground being economised for the culture of the indispensable adjuncts of even a small garden, when kept in good condition. Parsley, Lettuce, Radishes, and other similar small-growing crops could be worked in close up to the bush-fruits, when the latter are only grown in a single line.

Removal and Transit of Rubbish.—We have shown a means of exit in one corner; this should be secured if possible for the getting in of manure, and for the clearance of rubbish. This latter should not on any account be allowed to remain in heaps, but be removed on every available occasion before decay sets in. Cleanliness is needed in every garden. In a small one the opportunities are more abundant to secure this necessary point.

Vegetables.—With respect to the vegetables best suited for a small garden few remarks are necessary. It is not advisable to grow large patches of any given sort, of Potatoes in particular. If any of this every-day vegetable are cultivated, only those with short haulm should be chosen, as giving the best possible return in a small space. The earliest sorts, too, should be selected; then, as the ground is cleared of the crop, another successional one can be got in without delay. Late Cauliflower, Broccoli, Colewort, Cabbages, Turnips, or Spinach would be good selections. In the case of neither of these vegetables would any preparation of the ground be necessary beyond levelling it after the Potato crop, and the clearance of weeds; digging the soil or the addition of manure not being required in either case.

Peas are always appreciated when grown in one's own garden, and to obtain a good crop is always very satisfactory. We advise those kinds classified as dwarf Peas to be chiefly relied upon. These can be grown without the aid of sticks, which is a consideration when purchase of the same has to be resorted to. The dwarf Peas, too, can be grown much nearer together in the rows, the tall varieties taking up too much space in a small garden. As these are cleared off, another crop should be chosen to take their place. After the earlier varieties Spinach or Turnips would be a good selection, but after the late kinds we would advise the planting of a bed of Cabbage plants for spring cutting. After these are cut in the spring, the stumps should be rooted up, and then the ground would be available for a few rows of Celery. Manure should have been used for the Cabbage crop, and a little also in the Celery trenches. When the Celery is cleared away, the ground could be levelled off, and left in readiness for Peas again. Having received a good working when under culture with the Celery crop, renders it well calculated to bring a crop of Peas to perfection. Early Cauliflowers or Onions would also follow the Celery very well; we do not advise many Onions to be grown, they being purchased very cheaply in most localities. Scarlet Runner Beans are a paying crop, and an investment in sticks for a row or two of this vegetable would amply repay for the outlay. French Beans (dwarf) are also easily grown, and scarcely need recommendation. If the room at disposal is very limited, we would prefer them to the Scarlet Runners. A few rows of Brussels Sprouts would be of excellent service; they could be planted between the rows of Potatoes, provided the latter vegetable was given somewhat more space between the rows, say 2 ft. 6 in. Vegetable Marrows require some considerable space, and a rich soil, in order to succeed well with them; we would only advise a limited space being allotted for these.

Carrots, Parsnips, Leeks, and Savoy Cabbages had better be left out of the list. The former vegetable is very uncertain in some districts, and the perfume from the Leeks is not of the most agreeable kind during the late autumn, especially after a few sharp frosts. If any Savoys are grown, that kind known as "Tom Thumb" will be found the best, occupying but little space. With the protection of a cold frame during the winter months, some early Cauliflowers should be grown. A portion of ground that bore a late autumn crop should be prepared during the winter to receive the young plants about the end of February. Asparagus is a well-known delicious vegetable, but requires a considerable amount of room. If any is grown, we again advise the French mode of culture in rows, not in beds as under the old English system. Broad Beans might be dotted between the Potato sets here

and there, thus occupying no material space of ground.

We would now draw attention to the vegetables grown as salads. These are, we venture to think, well worthy of more attention than they generally receive in small gardens. Lettuces could be grown between other crops that are in an early stage of growth, and be well out of the way before any harm is done to either crop. Attention will be needed in order to obtain a succession; this, by sowing and transplanting every few weeks, can be, generally speaking, well secured throughout the summer months. Endive can be arranged for during the late autumn and early part of the winter with a little protection. Some few rows of Beet-root will be found of much service, being easily cultivated of sufficient size for all requirements. Radishes can be sown in patches wherever there is an odd piece of ground vacant. The common Watercress should not be overlooked; it will thrive well in any moist corner of the garden, especially if shaded from the noonday sun. When once sown, it will generally reproduce itself every season, with scarcely any attention to its culture. Mustard and Cress for small salad is of the easiest culture. In nearly every case when the growing of salads is attempted, the great thing to aim at is not to have too much of any one thing in fit condition for using at one and the same time. Small crops in various stages of growth will be by far the best course to pursue.

Some few kinds of herbs will invariably afford a more than usual amount of satisfaction, being far preferable to the purchases generally made of such products. Parsley, for instance, should receive prominent notice, being in almost daily demand. It will thrive well and present a good appearance when arranged as an edging next to the tiles at the sides of the paths. Mint, too, is of easy culture, not requiring much attention. Thyme, Chamomile, Fennel, Sage, and Tarragon, all herbs of a permanent character, should each have a small space devoted to their culture. Sweet and bush Basil, Marjoram, winter and summer Savory, Balm, and Borage can all be raised from seed annually, and should be allowed for according to the requirements. All these minor crops have already received special treatment in detail.

We would urge upon those who love their own productions, that have been grown under their immediate observation, to purchase at least a stout one-light garden frame. It would be useful, as previously advised, for wintering Cauliflowers, after the removal of which it would also come into use for Cucumbers during the summer months, and then be prepared for the Cauliflowers again.

Detailed and most explicit directions for the culture of all descriptions of vegetable products will be found in other articles, the perusal of which will be most profitable to the owner of even a small garden; it is not necessary, therefore, for us to enter into such matters here. The same may be said of the culture of fruits; we have here mentioned those that would be of most value, with only a few general hints which may be of service in this particular class of garden; the pruning of fruits, with illustrations and details of cultivation, will also be found elsewhere in this work. A list of the most suitable vegetables and fruits for a small garden, and a list of the best kinds of plants for the conservatory attached to the house, with such further details as may be necessary to obtaining in a small space the greatest result without too close and burdensome attention, will sufficiently complete this series of articles.

COMMON GARDEN FLOWERS.

Lily of the Valley (*Convallaria majalis*).—This is no doubt the most popular and best known of the whole family of Lilyworts, and with the single exception of the Violet—if even that is an exception—it is the most delightfully fragrant plant in all the garden. It is a native of Britain, and indigenous to various parts of the country, and is also found wild over large tracts of the colder parts of Europe and Asia. It is mostly found in shady woods, and where it finds a congenial home the roots will run almost like Spear-grass, soon overspread and take full possession of large areas, covering them with dense canopies of leaves, and these again are silvered over throughout the months of May and June with the gracefully-bearing flower-stems that ring out from their bending steeples their silvern bells, more redolent of sweetness, however, than productive of sound. The name *Convallaria* is said to be derived from *convallis*, a valley, and *rica*, a mantle, and is therefore at once descriptive of the density of growth and the favoured natural habitat of the plant. The English name, Lily of the Valley, is thus but a literal rendering of the botanical name *Convallaria*.

There is but one species, *majalis*, for the so-called *C. bifolia* is a widely different plant, with two leaves only, and has been transferred to the genus *Maianthemum*. There are, however, several very distinct varieties, and among these the larger one, *major*, which has larger, stronger flower-stems, with more numerous and larger bells, and much broader leaves of more substance, is by far the best. This is also known as the German or Continental variety. It, however, retains its character in this

country, though it needs liberal culture to bring it up to the high standard of imported clumps. With this and full exposure to sunshine during its growth, this variety grown in England is almost equal to imported crowns, and so enormous is the demand for Lily of the Valley for pot-culture and early forcing, that its culture for this purpose has now grown into a special and profitable trade in England, as it has long been on the Continent; and perhaps, looking at it in this light, there is more money in the Lily of the Valley than in any other plant in our gardens or woods. This and other points will be more fully adverted to under the head of Flower Forcing. We have only or chiefly to do with its merits as a common garden plant here. The common variety, with narrower leaves, and smaller, more slender flower-stems, is the one most common in gardens, and gets naturalised in many woods and shrubberies. Whilst far from asserting that this should be superseded by the other and larger kind, it would be most desirable to add the latter to the former. The double variety, *C. majalis florepleno*, seems a Valley Lily half spoilt and robbed of much of its elegance and grace. The same remark is even more applicable to the red variety, *C. m. rubrum*. The Valley Lily is one of those cases in which the colour, or rather want of it, is one of the essentials of the flower, and hence a red Valley Lily is robbed of full half its charm. The variegated-leaved variety, however, is worth growing, as its handsome foliage, striped or blotched with gold, enables it, where it does well, to rank high as a variegated plant. This sort, which is rather rare, seems a sport from the larger-leaved and flowered strain of Valley Lilies known as *major*.

The Lily of the Valley is by no means particular about soil, and may be said almost to thrive equally well in sunshine and in shadow, though the latter is mostly selected for it. But it does best in deep, rather rich loam, or soils rich in humus, such as those formed by the decomposition of leaves in old woods, or by incessant manurial dressings as in old kitchen gardens. At no season of its growth should it be allowed to suffer for lack of water. An annual top-dressing over the crowns in the early autumn is also most useful, and as the running roots run fast and far, and break up into stems and flower-shoots almost at every joint, the plants soon run into a perfect thicket in which they smother each other, and should therefore be often lifted and divided, only however operating upon a portion at one time. In this way a good stock will always be had of the best quality. Not a few never think of interfering with their Valley Lilies, and simply leave them to take care of themselves. This, in so far as their mere living and holding their own against all rivals, they are well able to do. But if fine foliage and good flowers are desired, liberal culture is needful to obtain them. It is true any part of the garden may grow Valley Lilies, but no portion of it can be too good to grow them to the highest perfection. A few patches or clumps should always be grown near the dwelling-house, so that its fragrance may be mixed with the odours of Violets, Roses, Sweet-briars, Gillyflowers, Mignonette, and Jasmine, in filling the house with sweetness. A few clumps lifted any time from December to March, and placed in a sunny window, will anticipate the natural season of blooming by a month or six weeks, or even two months. And no plant can bring into the house more of fragrance or of sentiment, than a few pots or boxes of Valley Lilies in the window.

Solomon's Seal (*Polygonatum*).—This is another small order of the great family of Lilyworts, and somewhat resembles a huge Valley Lily, rising in the different species from a foot to a yard in height. The flower-stem is bent much in the same way, but the leaves are arranged on each side of it, and the white bell-like flowers droop from the under side. These are, however, much larger and less white than in the Valley Lilies, and have little scent, though one variety is fragrant. The name is said to be derived from the many-jointed character of the stem (*poly*, many; *gonu*, joint or knee). The English name is derived from the peculiar knots on the roots of some of the species, such as *P. officinale*, which when cut across have a striking appearance that has been fancifully compared to the impress of the seal of Solomon. Possibly this peculiarity might be the more readily revealed from the fact that the roots were often dug up, cut into sections, and applied to fresh wounds or bruises as an antidote to pain and to prevent discolouration. Boys at school in the olden times, however ignorant of most plants, nearly all knew Solomon's Seal, and many were the roots dug up, sliced, and used after their pugilistic encounters. Hence possibly, to some extent, the immense popularity of this plant, which, however, deserves a place in every garden for its stateliness and beauty, independent of its fancied healing merits, or the hieroglyphics supposed to be half concealed, half revealed, in a cross-section of the swollen portions of its curious roots. The plant flowers in May and June, and is among the most showy of all the plants in the mixed bed or herbaceous border while they last in flower. It may also be lifted and gently forced into flower at almost any season after November; or a few placed in the window, as advised for Valley Lilies, will flower well, and prove highly ornamental in such positions. Solomon's Seal is also well adapted for cutting, and

lasts well in vases in cool rooms. There are several varieties of the different species *vulgare* which are all worth growing, also a double-flowered variety which is rare, and a more dwarf form of the latter.

P. latifolium is a bold, broad-leaved species, with flower-stems rising to three feet.

P. multiflorum is the species most generally grown in gardens, and as it is a native of Britain, it is also one of the hardiest and best.

P. pubescens, or Downy-leaved Solomon's Seal, is a strikingly distinct species.

P. japonica.—This differs considerably from either of the foregoing, the flower-stems being of a darker colour, and the habit more upright. There are several other species, but these will be found sufficient for almost any sized garden.

The plant can be multiplied to any extent desired by division, and hence it is hardly needful to raise it from seed. In general terms it may be stated that any root-joint with a knot or knob on the end of it may be converted into a plant by simply dissecting it into fragments, and planting it pretty firmly about two or three inches deep in the ground. Light, rich, rather deep loam suits these plants best, and to maintain them in full vigour, fresh plantations and new sites should be made pretty often from the strong running shoots found on the outer extremities of established clumps or masses. The old ones should, however, never be broken up, nor done away with, until the new clumps become firmly established, and have grown into such condition as to flower in quantity as before, and in far higher quality. If grown in front of shrubberies, as they often are, the plants will need good soil and frequent top-dressing to sustain their strength. The best places for Solomon's Seal are just those in which one so frequently finds it, about the middle line of mixed herbaceous beds or borders, with Phloxes, Michaelmas Daisies, Golden Rods, &c., behind, and Pæonies, Stocks, Wallflowers, Asters, Marigolds, &c., in front of it.

Bachelor's Buttons.—In his interesting book on the "Popular Names of British Plants," Dr. Prior informs us that Bachelor's Buttons is "a name given to several flowers 'from their similitude to the jagged cloathe buttons antiently worne in the kingdom,' according to Johnson's Gerarde, but ascribed by other writers to a 'habit of country fellows to carry them in their pockets to divine their success with their sweethearts.'" In some parts of the country the name is applied to the red-flowered *Lychnis diurna*, in others to *Scabiosa succisa*, the Devil's-bit Scabious, a blue-flowered perennial, growing in grassy and rather moist pastures. In modern gardens the term Bachelor's Buttons has come to be associated with *Ranunculus acris flore pleno*, a double form of the Upright Meadow Buttercup, which is a very common native herb found in meadows and pastures throughout Europe. How and when the double form originated we cannot say, but it produces branching flower-stems surmounted with medium-sized and very symmetrical golden flowers; and it has come to be cultivated in borders for its beauty, freedom, and durability. It truly deserves a place in every select collection of hardy perennials; it grows freely, and does well in ordinary garden soil, but a good yellow loam suits it best. It is a plant that can be easily increased by means of division of the roots.

Fair Maids of France.—This is *Ranunculus aconitifolius flore pleno*, a very fine Crowfoot, introduced from France. Like the foregoing, there is a single as well as a double-flowered form; the former, which was introduced from the moist parts and valleys of the Alps and Pyrenees, is not often met with, but the double form finds a place among select hardy border plants. It is indeed one of the best of our hardy perennials; the flowers are pure white and exceedingly double, not unlike a miniature double white Camellia. The plant forms a branching bush, two feet or so in height, and it grows freely in any moist situation. A deep moist loam suits it well; and the plants can be increased at any time by dividing the roots. It is one of those things that when once grown will not soon be given up.

Meadow Rue.—This name is applied to two or three varieties of *Thalictrum*, which come under the denomination of "Flowers of the Field." Our object is to introduce to our readers the Columbine Meadow Rue, *Thalictrum aquilegifolium*, a native of Germany and other parts of Central Europe. This is named the Columbine Meadow Rue because the leaves of the plant are like those of the Columbine, and it bears pale purple flowers. There is a variety named *roseum*, in which the flowers are rose-coloured; and both are stately plants, well deserving a place in the garden. It is a very accommodating plant, flourishing in any soil, but, like nearly all the perennials, it does well in a good loam.

Columbine (*Aquilegia vulgaris*).—This charming flower, which is a true British species, though abounding also in most parts of Europe and Japan, is a great favourite among our most popular common flowers. It derives its name, Columbine, from the fancied resemblance of its flowers to a nest of doves, *columba* being the Latin for dove. When growing wild, its flowers are usually white or blue. It may be distinguished from all other British flowers by

having each of its five petals terminated in an incurved horn-like spur. We have now many beautiful varieties in our gardens, but it is doubtful if we have advanced much beyond what our forefathers possessed one hundred and fifty years ago; then "there were great varieties of this plant, the flowers of which are very double, and beautifully variegated with blue, purple, red, and white." But we have one great advantage over our forefathers, in that we inherit several very handsome and striking species that were introduced from the Alps of Europe, from the Rocky Mountains, from the Himalayas, and elsewhere: species varying much in character of flower, and habit of growth; some less hardy than our common Columbine; but all of great value, and which have been used for crossing purposes, placing us in possession of many beautiful garden varieties. *A. alpina*, *A. chrysantha*, *A. cærulea*, *A. glandulosa*, and *A. Skinneri*, among others, may be mentioned as particularly deserving of attention as introduced species, and they have produced forms of great beauty.

Columbine (Aquilegia vulgaris).

The common Columbine is perfectly hardy, and it will flourish in stiff wet soils where many other plants will fail; and it will also do well under the shade of trees. Many of the double varieties are exceedingly beautiful, especially some that have dark colours, edged with white on their many petals. Some admire the single varieties most; others, the double; but all are well deserving of cultivation, and when once grown will not soon be abandoned again.

Aquilegias are propagated by means of seed, and it should be sown in pots or pans of good, light soil, early in March, which place in a cold frame: the seeds will soon grow, and when the plants are strong enough they should be planted out in the open ground, in rich soil. If the season is favourable to a quick growth, most of the seedlings raised from the seed sown in March will flower, and so they would be practically annuals. The general rule, however, is to sow in June, in the open air, on a warm border. The Aquilegia is a very hardy plant; the severest frosts do not injure the common varieties; but such species as *cærulea*, *glandulosa*, and others, are less hardy, and require to be grown in a lighter soil in a more elevated position, excessive damp often being fatal to them.

Any fine varieties that it is desirable to increase

can be multiplied by division of the roots. A strong plant, say one two years old, can be divided, if carefully done, into two or three, and in this way a number of plants can soon be had. Seed cannot be depended upon to produce exactly the form it is desired to preserve. Some will be true to character, but a great many will sport into other colours, as is common with many other flowers.

The Dianthus. (We get this name from *dios*, divine, and *anthos*, a flower).—Under this heading there is included a large tribe of hardy, and we might say charming flowers. The Carnation, Picotee, and Pink are dealt with elsewhere, and they are all Dianthuses. There is the Alpine Pink (*D. alpinus*), the beautiful mountain Pink from the Alps of Austria, that does well on exposed spots, planted in a light, gritty loam, where it can remain undisturbed. There is the Cheddar Pink (*D. cæsius*), which can be found on the limestone rocks at Cheddar, in Somersetshire: a dwarf-growing kind, producing dense tufts, and flourishing in dry sandy borders, and on rock-work. There is the Maiden Pink (*D. deltoides*), which is found in Europe, Asia, and Britain, but not in Ireland; forming grassy tufts, and making a pretty rock plant. There is the Glacier Pink (*D. glacialis*), a charming but very dwarf plant, only two or three inches in height, and which is found on the granitic Alps of the Tyrol. These, together with a few others not so well known, make up a group of rock plants of a very pleasing character, that are wonderfully pretty when thoroughly established in suitable spots. Some persons grow them in pots in gritty soil, and very pretty indeed they are when well managed.

There is also the Fringed Pink (*D. superbus*), a tall-growing handsome form, fragrant, height twelve to eighteen inches, the petals of the flowers having the appearance of being cut into strips for more than half their length. With the exception of the last-named the foregoing are all hardy perennials, and in light soils *D. superbus*, though really a biennial, will become quite perennial in character.

Eastern Queen.
Brilliant. Crimson Belle.
DIANTHUS CHINENSIS HEDDEWIGII.

SWEET WILLIAM.—The dear old Sweet William of our gardens is *Dianthus barbatus*, which means bearded. It is as common in gardens as some weeds. If it is not in a garden, there is something wanting. This is not an English flower, though found in almost every English garden, but it originally came to us from various parts of Central and Southern Europe. Though regarded as a biennial, it is in some soils a perennial; but those desiring to have fine flowers will do well to sow some seed every year. This is best done in May and June, because the plants have time to grow strongly, and they can then be depended upon to flower the next year. The Sweet William has been greatly improved during the last twenty-five years. A Mr. Joseph Hunt, of High Wycombe, was fortunate in raising a strain, fine and varied in colour, with large bold pips with smooth edges, borne on fine trusses of flower. Then Mr. W. Dean, Shipley, Yorkshire, raised what he called an Auricula-eyed strain, having fine pips also, some with smooth and some with fringed edges, but all having striking white centres. The seed can be sown in shallow

boxes, or in beds of fine soil in the open ground, and when the plants are large enough, transplanted to where they have to flower. The plants should not be starved; they should be in a rich deep loam, where they can root freely, and then they flower very finely. There are a few double varieties that are esteemed because more lasting in character, but they are not nearly so showy as the single forms. One, a dwarf-growing and very free-flowering bright crimson-coloured variety, is very showy in the open border. In the market gardens round London a dark reddish-leaved single variety is grown, which is sometimes used for filling flower-beds in spring.

Mule Pinks.—There is a group of Mule Pinks of a very showy and useful character. They are grouped under the head of *Dianthus hybridus*, and include several varieties of different shades of colour, bearing medium-sized double flowers. In habit of growth they greatly resemble the Sweet William, and they have probably been obtained from a cross between the Carnation and the Sweet William. They are of vigorous growth, and very free-blooming, and make excellent border plants. They are more persistent in flowering than some other members of the Dianthus tribe, in that they throw up successional flower-stems. The varieties can be increased by means of cuttings, and division of the roots. The colours are varied—from pale pink to deep crimson through many pleasing shades. They are mainly of Continental origin, and new varieties occasionally come to England from abroad. Some of these Mule Pinks should find a place in the border of hardy plants. A few of the best varieties are—Marie Paré, Multiflorus, Highclere, Napoleon III., Rosetta, and Striatiflorus.

Indian Pinks.—These are varieties of *D. chinensis*, the China Pink, which was introduced in 1713. It has become greatly improved during the past few years; there are now a great number of varieties of varied colours, both double and single, and all worthy a place in the garden. Those who have to supply cut flowers should make a practice of having a line or small bed of this useful Dianthus, which, though classed with the biennials, can be treated as an annual, for if the seeds are sown in the open air in early spring the plants will flower the following summer, and they keep blooming until quite late in the year; the more they are cut, the more flowers are produced. There is a larger-flowered form of the Indian Pink, known as *Dianthus chinensis Heddewigii;* it was raised by Mr. Heddewig, of St. Petersburg, about 1858 or 1859, and represented a very large-flowering single Indian Pink, of great beauty, and with smooth edges to the petals. As it seeded freely, seedlings were soon obtained from it, and one of the earliest was *laciniatus*, having very handsome fringed flowers. Seedlings were found to show a great variety of colours and character; and later on double forms began to appear, and they reproduced themselves from seed. We think the single forms preferable to the double, and a few of the former have proved so fine in character that they have been named, such as Crimson Belle, Brilliant, Eastern Queen, &c., all very beautiful; Brilliant is remarkable for its rich vermilion hue. Seed of these fine forms should be sown in early spring on good soil in the open ground, the plants thinned out, and then they will flower finely during the summer.

Delphiniums.—These are known as the perennial Larkspurs, and the name was given from *delphin*, a dolphin, because of the supposed resemblance of the spur of the flower to a dolphin's head. *D. elatum* is the Bee Larkspur, and was introduced from Siberia nearly 300 years ago. As far back as 1817 one of the most reliable catalogues of plants published at that time gives only nine species and varieties, but since that time there has been a great increase, and new varieties are constantly being raised both at home and abroad. It would be very difficult to trace back the descent of these, but we may fairly assume that they are the result of crossing the different species and varieties, and so obtaining new types. There are now in cultivation nearly one hundred varieties, mostly of great beauty, all hardy in character, varying in colour and size of the flowers—some double and some single, some tall-growing and some dwarf-growing—stately plants, flowering freely, very showy, and producing magnificent spikes of bloom.

The culture of the Delphinium can be set forth in a few words. It succeeds best on a rich, deep, mellow loam, where the plants have ample space in which to develop themselves. If left alone for a few years they grow into very strong plants, but they are greatly helped by being mulched with manure in spring and autumn. In order to have fine spikes of flower, it is best to lift and re-plant once in two or three years, digging and well manuring the ground. An open and sunny spot suits the Delphinium best, but it should be of a character of soil into which the plants can strike their roots deeply, or they will be apt to suffer during a time of drought. If any one wishes to enjoy the Delphinium they would do well to plant a bed of different varieties, placing the tallest in the middle, and the dwarfer-growing varieties round the sides. In dry weather the plants must be freely watered, and a mulching of leaves and dung during the summer will greatly help to keep the soil cool and moist.

As Delphiniums are generally free seeders, young plants can be raised from seeds. It is not very often resorted to, perhaps, because the named varieties in cultivation are so handsome and good that people find

seedlings are no improvement upon them; also the seeds are slow to germinate, and much patience is required, and if the seed is kept for a time its germinating power becomes lost. The seed of some of the sorts will not germinate for a whole year. Those who have a desire to raise seedlings would do well to take some seeds from a few of the best varieties they may grow, and sow it as soon as it is ripe in shallow boxes filled with a light soil, placing them in a cold frame, moistening the surface when necessary, and waiting patiently for the young plants to appear. When they are large enough they should be transplanted to a warm border to grow into size, and then they can be planted out where they are to flower.

Choice varieties can be increased by division of the roots. In order to have young growths out of which to make plants, the flower-stems should be cut away as soon as they have done blooming, and the plants be well watered if necessary; they will then begin to put up young growths, and by careful division of these when strong enough a number of young plants can be obtained. As a matter of precaution, it is well to put them singly into pots, using a suitable soil, and keep them in a cold frame, shading from the sun, and occasionally sprinkling overhead in drying weather. When they have made roots they can be placed in the open border with the certainty of success.

Some thirty or so years ago, Mr. W. Lobb, the collector, sent home from California a scarlet-flowered Delphinium, named *cardinale*, of which great expectations were formed; but it was found difficult to cultivate successfully in this country, and now it has become almost extinct. It was hoped that it would prove a valuable species for hybridising, but we believe nothing came of it. A few years ago, *D. nudicaule* (the Dwarf Red Delphinium) was introduced from California, and being much more capable of naturalisation than *D. cardinale*, it has become a favourite in gardens; but it requires to be grown in a warm position. On a stiff wet soil, it soon rots. When it dies down in autumn, the roots are quite on the surface, and it is a good and safe plan to cover them with some good soil to insure their growth in spring. It deserves the little extra care it requires, for it is a charming species.

The following makes a fine selection of Delphiniums:—

Double-flowered Varieties.

Alopecuroides, bronzy-blue.
Britannicus, rosy-lilac and bright blue
Dicksands, deep plum-purple and pink. [lilac.
Exquisite, cobalt-blue and
Hermann Stenger, violet and blue.
Lamartine, rosy-lilac and azure-blue.
Michelet, blue and lilac.
Mozart, mauve, blue and rose
Noblissima, blue, rosy-lilac, and orange.
Paul et Virginie, bright blue, bronzy-red, and white.
Ranunculæflorum, bronzy-lilac and cobalt-blue.
Victory, violet-blue, lilac, and white.

Single-flowered Varieties.

Admiration, violet-blue and white.
Brilliant, shining indigo-blue.
Cantab, pale blue, white centre.
Enchantress, lavender-blue.
Formosum, dark blue.
Illustration, blue and lilac.
La Belle Alliance, sky-blue, white, and orange.
Madame A. Etienne, clear violet.
Magnificum, brilliant blue and bronzy-red.
Miss Payne, azure-blue.
M. Rivière, violet-red.
Mr. Gerard Leigh, sky-blue.

THE LIFE-HISTORY OF PLANTS.

By Dr. Maxwell T. Masters, F.R.S.

GROWTH—BULBS, CORMS, AND TUBERS.

IN pursuance of our plan of tracing the history of plant-growth from its several starting-points onwards, we come now to the consideration of a number of organs differing from either seeds or buds, but having much analogy to both. And first of Bulbs.

Varieties in Bulbs.—There are many different sorts of bulbs, as any one may see who compares that of an Onion or a Hyacinth with that of a White Lily, that of a Snowdrop or a Tulip with that of an Amaryllis. It forms no part of our plan to describe all these varieties in detail, though we strongly recommend the young gardener to examine the mode of growth of bulbs of various kinds at various stages, as a valuable means of gaining an insight into the course of plant-life. Here we can only point out the main circumstances upon which the variations depend, and suggest some of the inferences that may be drawn as to the nature of bulbs, the work they do, and their appropriate treatment. Speaking generally, they consist of a number of leaf-scales, enclosing or wrapping round a central growing point; and so far they exactly correspond with the buds. Like many buds, they contain not only the rudiments of leaves, but the beginnings of the flowers; like many buds also, they often contain the germ, not only of the next season's growth, but of that of subsequent ones also; or, at least, they contain growing points of different generations, just as was pointed out in the case of the Ash (Fig. 18, p. 195). The individuality or independence which has been already mentioned as one of the characteristics of ordinary buds, is much more marked in that modification of a bud which we call a bulb. Indeed, a bulb, as a rule, constitutes the whole of the plant; but it may be merely the terminal bud of an underground stem or branch, and hence, though there is usually no difficulty in defining a bulb, there are sometimes cases in which it is difficult or impossible to draw a line of demarcation between it and other structures like buds—

tubers, root-stocks, &c. The differences between bulbs and buds depend on the fact that while the bud is usually one of many connected together by a common branch or stem, the bulb itself may, and often does, constitute the entire plant, and for the most part, though not exclusively, it is subterranean in its mode of growth.

From our present point of view, however, the great distinction lies in the different nature of the scales. The bud-scales, as we have seen, serve to protect the young growing point within from undue cooling or radiation, and from drying up by loss of moisture from the interior; but they do not serve as store-organs, and the growing point, as it lengthens into a shoot, derives little or none of its supplies of water or food from the scales. Their purpose fulfilled, they are cast off and are of no further use, unless it be to restore to the soil some of the earthy ingredients derived from it, and of which they contain considerable quantities. In the case of the bulb it is quite different—whether the scales wrap round the growing point, as in the Onion or the Hyacinth, or whether each individual scale only covers a portion of the bulb, as in the Lily (Fig. 26), just as a single tile or slate covers its portion of the roof. In both cases the scales are filled with food accumulated in the past season and intended for use in a future one, after an interval of rest. When a Hyacinth or other bulb commences to grow, it uses the food stored up in its own tissues, and does not, for some time at least, derive much, if any, nourishment (save perhaps water) from the water or soil in which it is placed. A due supply of water may be necessary to help in the solution of the nutritive matter and insure its easy transport to the points where it is most needed. It is this necessity for an abundant supply of water which leads gardeners to recommend the bulbs intended to be grown in glasses to be put in a dark place and in a warm cupboard before they are exposed to the light. The object of this is to aid the development of the roots, and by their means to secure a supply of water to facilitate the subsequent steady, uninterrupted growth of the leaves and of the flower-stalk.

Fig. 26.—The Bulb of the Common White Lily.

So far as the flowers are concerned, their growth depends more upon the amount of food stored up in the bulb the season previous than it does upon any supplies obtained this present season.

The production of flowers is, however, not the only work the bulb has to accomplish. New bulbs have to be formed and fresh stores accumulated in them, and to fulfil these ends aright, leaf-action must be proportionately vigorous. This subject of leaf-action will have to be treated of further on; we allude to the subject now incidentally to protest against the barbarous practice of some "jobbing" gardeners ignorant of their craft, and of amateurs exercising no thought, of cutting off the foliage from the bulbs, or what comes to the same thing, from the "corms" of their Crocuses. Every leaf should be left on so long as it is capable of doing efficient work. When its work is coming to an end—when the sere and yellow leaf appears—then is the time to remove it. This is the indication that the bulb is going to rest, and that rest may effectually be secured by "lifting," *i.e.*, digging up the bulbs, drying them off, and keeping them as the Dutch bulb-growers do, in a dry place, under a uniform temperature, so that nothing shall stimulate growth till the desired time. It may be objected that in nature the bulbs are not dug up and treated in this way, and that is of course true. The same object is, however, attained in a different way. For the most part these bulbous plants are natives of hot dry climates, where, during the growing season, there is abundant rain and genial warmth. Exposed to these conditions, the bulb grows, flowers, and makes provision for the future. Then comes a hot dry season; the leaves shrivel, the surplus water evaporates, and the bulb goes to rest till reawakened in the following season by the rain. In colder climates the diminishing heat of autumn insures the gradual going to rest of the bulbs; frost puts a stop to growth altogether, and the bulb remains dormant till spring rains or melting snow afford sufficient water, in combination with sufficiently increased temperature, to start the bulb once more into growth.

There are other bulbs, however, in which the course of events is different; such, for instance, are the evergreen bulbs, like those of *Crinum* or

Eucharis. Here there is no such marked intermission of growth; the leaves do not wither periodically, and growth is relatively, at least, continuous. Such bulbs are mostly natives of tropical or equatorial climates, where throughout the year there are continuous moisture and continuous high temperature, with comparatively little fluctuation of climatic conditions. It is clear that to dry up such bulbs would be to weaken, probably kill them; hence their roots should always be kept moist, and a period of *comparative* rest secured by lowering the temperature and diminishing, but not entirely withholding, the water-supply.

The Bulb and the Flower.—The variations in bulb-conformation are, as already stated, numerous, but in this place no further mention need be made of them, except it be to point out the different positions of the flowers. In some bulbs, like those of the Onion or of the bulbous Irises, or Snowdrop, the primary growing point of the bulb ends in the production of a flower or a head of flowers; consequently any further growth in that particular direction is put a stop to, and any subsequent growth, if it occur at all, must be from below the point. A Tulip affords another illustration of the same kind. If a bulb be taken up in summer after the flowering is over, and when the leaves are commencing to wither, and it be cut down through the centre, the following appearances may be seen. In the centre is the lower part of the stalk which has borne the flowers. From the lower part of this stalk emerge the roots. On either side of the central column may be seen one or more plump new buds, destined to continue the growth next season. These buds originate from the base of the central column or stem, in the axil of one or other of the scales—in fact, in precisely the same way as before explained in the case of axillary buds. (See *ante*, p. 199.) Outside these new buds may be seen two or three scales now dry or rapidly shrivelling, which are the outer scales of the original bulb.

In this case, then, the original bulb flowers, makes provision for the future, and then dies. The Tulip of the present year is, therefore, not the same bulb as that of the year preceding, but a direct descendant from it.

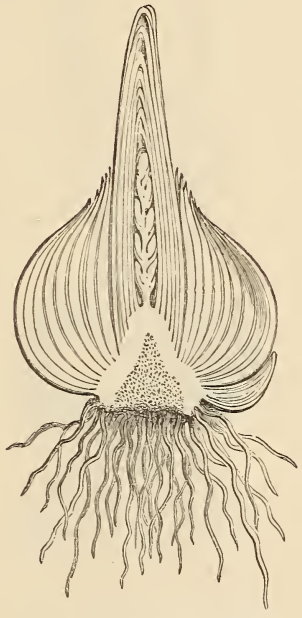


Fig. 27.—Section of Hyacinth.

The Amaryllis, Hyacinth, and Narcissus have bulbs of a different character (Fig. 27). In them the primary growing point does not end in a flower, but remains as a vegetative structure. The illustration at Fig. 27 does not clearly indicate the true nature of the flower-spike, which appears to be, but is not, terminal. The flower-stalks here are truly axillary structures, coming off from the sides of the bulb. As the older scales at the outside and base of the bulb dry up and die, new growth takes place in the terminal growing point, and so in this case the bulb of the present year is the direct continuation of that of the year preceding. Vegetation is carried on by the renewed growth of the same original growing point, but axillary growth also takes place, for in general, not only the flower-stalk, but numerous lateral "offsets," will be produced from such bulbs, and, indeed, it is by such means that bulb-growers multiply their stock. Mention has also previously been made of adventitious buds, and of buds whose dormant activity is called into life by injury to the main stem. Bulbs often supply illustrations of this phenomenon, and one means of multiplying bulbs of the Hyacinth is to scoop out the lower part of the bulb, or to cut it across in various directions. Along the edges of the wound a vast number of small bulbules are formed, at first consisting of scales only, but which after two or three years' growth produce flowers in the ordinary way.

Another point may be alluded to as having a bearing on practical cultivation, and that is the difference in the leaves of the bulbs and the alternation of form and office which they present. It is hardly necessary to say that the scales of a bulb and the true leaves are essentially the same, the one being merely a modification of the other. The position, origin, and arrangement of the organs in question would suffice to prove their identity, were it not rendered even more obvious by the fact that the base of the leaf is often fleshy, the free end foliaceous, thus presenting both phases in one and the same organ. Ordinarily, however, there is an alternation of growth. First the bulb-scales are formed; these are depôts of food-stores derived and accumulated from the leaves of the parent bulb; then the true leaves appear within the scales, they lengthen, and

in their turn acquire and elaborate food for the next generation of bulbs. In the Hyacinth and bulbs of that character there are, from what has been said, numerous generations of leaves, first scaly and acting as food-stores, next leafy and acting as food-getters and food-formers. In the Tulip, on the other hand, owing to its mode of growth, there are but two generations of leaves—the first scaly, the next leafy—and then there is an end to the growth of the plant, so far as that generation is concerned. The subsequent alternations of scale and leaf manifest themselves not in the primary bulb, which wears itself out in the production of flowers and succession buds, but in those secondary buds.

We have here illustrated two phenomena of plant-growth, which are repeated in other organs, but to which we desire to call attention here on account of the very marked manner in which they are manifested. These two phenomena are (1) the alternate production of modifications of the same organs, these modifications being adapted to serve distinct purposes; and (2) the "indefinite" and "definite" modes of growth respectively. We shall see later on that where the main flower-stalk ends in a flower (as in the Tulip), there is no further growth at the end of that stalk; growth there is arrested or defined by the production of a flower; but where the growing point at the extremity of a stem does not end in a flower, growth in length goes on "indefinitely."

Fig. 28.—Corm of Crocus, with new growths issuing from the top of the old one.

The remarks made as to the nature and mode of growth of bulbs apply, with slight modification, to other underground organs acting as store-houses of food or starting-points of growth, such as "corms," "tubers," "root-stocks," or "rhizomes," and the like. Indeed, although in most cases it is easy to give satisfactory definitions of these organs, yet they sometimes run one into another in such a way that accurate definition becomes impossible. These are matters, however, which do not greatly concern us from the point of view of practical cultivation. If only the general principles of their growth and of the work they have to do be grasped, the varied details of their conformation may be left to the botanist. We may, however, fitly allude to some of the commoner and best-known forms above mentioned.

Corms.—As usually understood, corms or "solid bulbs," as they are also called, differ from bulbs in this, that the scales on the outside are dry and few in number, while the base or lower part of the stem from which they spring is greatly dilated. The depôt of nutriment in this case is therefore in the stem, not in the scales.

The Crocus and the Gladiolus afford familiar examples of the corm. Their mode of growth is the same as to general principles as that of the bulbs. The Gladiolus, for instance, affords an illustration of a terminal corm; the main stem ends in the inflorescence which, together with the old corm, withers after flowering, leaving a lower bud of axillary origin to carry on the growth in the next season. A Gladiolus corm examined in the spring of the year shows the withered remnants of the old corm, surmounted by the new one, from the base of which proceed the roots. On removing the base of the sheathing leaves, small buds may be seen in the axil, which will not flower this season, but in a subsequent one.

In the Crocus the new corms formed in spring are developed from the top of the old corm, as shown in Figs. 28 and 29. They are for a longer time dependent on the old corm than in the case of the Gladiolus, as may be seen by the fact that roots proceed from the base of the new corm in spring, while at the same period, in the case of the Crocus, there are no roots yet produced from the new corm, the withering old corm still retaining its roots. "Every living part of a Crocus," says Mr. Maw, "is annually replaced. The corm tunic is the only permanent record of perennial existence, and even this in its living state lasts but a year." The general mode of growth is thus essentially similar to that already mentioned in the case of the Tulip. Considering, then, the short time that a Crocus has wherein to develop its flowers, its leaves, and its successional corms, the folly of cutting off the leaves prematurely becomes the more apparent.

Tubers.—For our present purpose we may consider a tuber to be a thickened shoot, without any investing scales, but with one or more "eyes," that is, buds. In a bulb or a corm the central stem from which the scales and leaves proceed is short and

thick; in a tuber it is usually more or less elongated. It is, however, rather in their production at the ends of longish thread-like branches that the difference mainly consists. Tubers are generally grouped by gardeners as forms of roots; but this arrangement by no means pleases the botanist, and is, indeed, fatal to clearness of conception, while the treatment that is appropriate to a tuber is by no means suitable to a root. The technical difference, not to mention differences of structure and mode of growth, consists in the fact that in a tuber there are eyes or buds, while a true root is destitute of these productions. Nevertheless, there are, as has been already mentioned, some awkward intermediate formations, the plague of the botanist, the despair of the devotee of exact science, which will not fit in comfortably with any definition that may be framed; such are the tubers of the Dahlia, of terrestrial Orchids, the thick stem of the Cyclamen, or the pseudo-bulb of the epiphytal* Orchids, and many others. However different morphologically—that is, structurally—they are but illustrations of nature's method of compassing the same ends by varied agents. They are very interesting to the morphologist and physiologist, but of little value to the systematic botanist, because they afford little or no indications of real affinity, plants of the most diverse lineage having in this matter similar structure. The most useful course appears to be to allude to such of these formations as are most important to the cultivator, and to do so from his point of view and that of the physiologist. So considered, all these nondescript structures fall very naturally and conveniently under the head of Reserve-organs, taking their place as such by the side of seeds, buds, bulbs, and other organs of storage, and illustrations of intermittent energy or suspended animation.

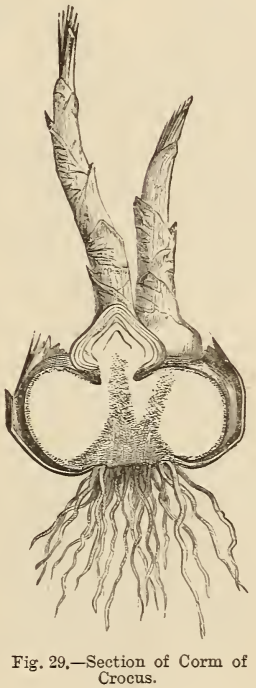


Fig. 29.—Section of Corm of Crocus.

First and foremost in importance is the Potato, "the noble tuber." Great as is its importance to us, that importance is largely artificial. Of the seven or eight hundred species of *Solanum* known in a wild state, only some half-dozen are known to produce tubers, and only one, *S. tuberosum*, the Potato *par excellence*, has been brought into cultivation. So far, all the numerous varieties of Potato in cultivation are mere seedling or selected variations from this one species. The point we would here impress is that the formation of tubers so important to us is clearly of vastly less significance to the members of the genus *Solanum*, in which, indeed, it can only be looked on as exceptional. The object of the cultivator should be directed not so much to the conditions under which the members of the genus *Solanum* naturally grow, as to the peculiar conditions which have caused one particular species in an especial manner to develop tubers. It must never be forgotten by the thoughtful cultivator that particular plants—wild plants—do not as a rule grow under the conditions which are the most favourable to them, but where they can hold their own in face of the severe competition to which they are exposed, and in spite of the many adverse conditions by which they are handicapped. This truth was long ago insisted on by Dean Herbert, one of the foremost physiologists and cultivators of this country, and it is a truth that should be full of encouragement to the gardener, who often has it in his power to remove any given plant from the struggle with competitors, and not only to banish adverse conditions, but to place the plant under the most favourable circumstances possible for its development. This is what has been done partially for the Potato; partially, because only with reference to the production of tubers, the tendency to the formation of which has been by the art of man, and the plasticity of the plant, enormously increased. But this development of one organ has been obtained at the expense of some compensatory drawbacks, foremost among which is an enhanced tendency to become diseased, or at any rate a diminished power of resistance when attacked.

The tuber of the Potato is nothing but the thickened end of an under-ground branch. As it is destined to remain under-ground, no true leaves are formed, and therefore any food it may get is conveyed to it, not formed by or in it. That it is a branch is shown by its origin from the stem or haulm, and this is further shown by the presence of the eyes or buds. The Fir-cone Potato, a variety occasionally met with, resembles a long Fir-cone

* Epiphytal, a term applied to plants which grow upon other trees, but which, as they do not penetrate beneath their surface, do not derive any nourishment from them.

or an Asparagus-shoot, the nature of which latter is obvious. It is, in fact, a terminal bud, such as before described, but one in which the central portion is enormously thickened, which ceases to grow at the tip (definite), but which is capable of lateral growth by development of shoots from the "eyes," as may be seen when "sets" or so-called "seed-potatoes" commence their growth (Fig. 30; see also Fig. 10, p. 24). Its essentially bud-like character is shown by the occasional formation of small tubers in the axils of the leaves. Any one who will compare a Strawberry "runner" with a Potato will see how close the correspondence really is. From the underground portion of the stem or haulm of the Potato slender branches are thrown out, which terminate in tuberous buds (Fig. 10), that do not directly develop true leaves, but become separated from the parent plant in course of time, and serve as a means of propagating it. From the above-ground portion of the stem of the Strawberry issues a long slender branch, which terminates in a bud, in which true leaves are directly developed, and which becomes in time detached from the parent plant and serves to propagate it. In all essentials the resemblance is close; the difference is associated with the circumstance that in the one case the growth takes place below-ground, where the leaves could not work if they were produced; in the other the growth is above-ground, and the leaves can effect their purpose so completely that the food stored up in the offset of the Strawberry is actually largely obtained by its own leaves, and not conveyed thither from other sources.

Fig. 30.—A Potato-plant.

Practical Inferences.—The life-history of the Potato, as here sketched in outline, illustrates the

propriety of not allowing the tubers to produce roots or to sprout till we are ready to plant, because all such growth must be at the expense of the parent tuber. But if planted before such growth takes place, then as soon as new roots are formed they are at once available to supply the tuber with water, and not overstrain it in carrying on those wonderful changes which convert a dormant mass of cellular tissue into a focus of movement and chemical and physical change.

So, too, we may see that the practice which some follow of rubbing off the "chits," or shoots that may have been produced, before planting is so much waste; they will form again, it is true, but a wanton injury will have been done and time will have been lost. It is the practice with some when planting to suppress all the eyes but one near one end of the tuber. The reason given for this is that the one left will be able to avail itself of the food provided for the rest. But if a good haulm is to be made —and that, it must be admitted, is the necessary precursor to a good crop—it must be bad practice to suppress the many for the sake of the one—to have one group of leaves and roots only instead of many. But supposing growth goes on uninterruptedly, the roots which emerge from the base of the shoots grow, divide and subdivide, multiply exceedingly, according to the nature and quality of the soil.

The value of the earthing-up process usually adopted consists in this: the earth drawn up round the collar increases the food-supplying surface, gives the roots more range, secures a greater supply of air to the roots through the loose soil, and, provided it be not raised too high, is of unmixed benefit to the plant. Moreover, under certain circumstances, it may prevent the spores of the Potato fungus being washed down into the soil—an argument used by Mr. Jensen in support of his practice of "high moulding." The first object of the cultivator is to encourage free, rapid, and healthy growth of root and haulm. The reason is obvious; root and leaf are necessary to the growth of the plant, and essential to the formation of the tubers. Once provided with a good supply by means of the true roots and leaves, the plant sets itself to work to provide for the future. It may do this in two ways—by the formation of flowers, fruit, and seed, or by the production of tubers. We may here leave seed-production out of our calculations, because in most cases it is the tubers we want, not the seeds, save in exceptional cases. At the same time that the roots below-ground and the haulm above-ground are doing their work, collecting and preparing the food, the tubers are gradually developing below-ground on the subterranean portions of the stem.

In its native country the Potato is exposed, after the growing season, to a period of drought, and all above-ground vegetation dries up, where with us it rots. In either case the destruction of the leafage is complete, and were it not for the tubers safely ensconced below-ground, the chance of perpetuating the plant would be small. True, it might be propagated by seed, but only a small proportion of seed is formed; that is subject to depredations from birds, and liable to other accidents; and, moreover, reproduction by its means is necessarily a slower process than that by the tubers buried safely beneath the ground, out of the reach of hungry animals or birds, and placed under more equable climatic conditions than they would be above-ground, where cold nights, and even frost, succeed to torrid days. The question obviously arises whether in this country autumn planting might not be more beneficial than that in spring. But it must be remembered that the Potato in our fields and gardens is under very different conditions to what it is in the wild state. Our cold, wet soils are not at all well adapted to keep such succulent masses; and, again, our spring frosts play havoc enough as it is with the young shoots, and would do still more in the case of autumn-planted tubers, unless protected.

THE VINE AND ITS FRUIT.

By William Coleman.

MANAGEMENT OF NEWLY-PLANTED VINES.

First Year.—Assuming that yearling vines (refer again to Fig. 13) of home growth have been planted in a house by the first of March, the permanent vines from five to six feet apart, and the supernumeraries midway between them, the great object will now be the production of an abundance of healthy foliage, roots, and well-ripened wood. The gentle fermentation in the borders, aided and maintained by a ridge of warm leaves, will facilitate the formation of new roots, and the buds will break strong under the influence of a minimum of fire-heat. As soon as the buds have pushed half an inch or a little more, gradually remove them from the temporary vines down to a little below the top of the front sash, leave the remainder to grow for a time, and when two of the strongest breaks take the lead, allow them to grow on together until the best is considered safe from accidents, then stop the weaker of the two.

Next turn attention to the permanent vines, and after disbudding down to three of the best buds close to the base of the young cane, allow one to grow up as a leader, and train the other two, one on each side, midway between the permanent and temporary vines. If the greater distance (six feet) has been allowed, these canes will be exactly eighteen

inches apart, a space which they will eventually cover with foliage. If the lesser distance has been decided upon, then one side shoot from each vine will be sufficient. The temperature from the time the vines are planted, until they are commencing free growth, should range from 50° to 56° at night, and 10° to 15° higher by day, but as no rule can be laid down for forcing early growth, progress should be made under the influence of sunshine and light, and rest allowed when the days are dark and cold. By the middle of April all the canes will be progressing favourably, having got over the temporary check which always takes place after the young growths have exhausted the stored-up sap, and the new roots have commenced sending up a fresh supply from below. When this period, which often extends over ten days, has been passed, raise the night temperature to about 60°, give air in the morning as soon as the thermometer rises to 70°, and gradually increase the top ventilation under a bright sun until the mercury touches 80°. Regularly sprinkle the floors through the day, keep the evaporating pans full, and also syringe every part of the house, including the foliage, after closing on fine afternoons.

In order to dispense with sharp firing as much as possible, early closing is an important point which should never be lost sight of. As days increase in length and brightness, the night temperature may be raised to 65° for such kinds as Hamburghs, and 70° for Muscats; and the section which enjoys Muscat treatment may rise 10° to 15° by day, more or less, according to the state of the weather. If not mulched, the borders, as yet loose and porous, will be in a fit state to receive a moderate supply of water at the mean temperature of the house, and more atmospheric moisture will be needed to support the young vines and foliage, which must be grown in full exposure to the sun. This moist growing condition can always be secured by damping the borders on fine mornings, and again at closing time, when a slight syringing will also be beneficial. But great care must be exercised in dull, cold weather, as anything approaching a sloppy state of the house, when air cannot be freely admitted, will produce excrescences on the lower sides of the leaves, usually the first ailment with which young beginners have to contend.

When the young canes begin to feel the full benefit of the new compost, they will grow with increasing vigour, and provided airing is properly attended to, the foliage will begin to assume a dense green colour with plenty of substance; laterals will push freely, and the leaders will require tying with soft bass every alternate day. From this stage forward the treatment should in every way be liberal; plenty of water must be given to the roots, the syringe may be freely plied at closing time, and clear liquid may be used for damping the floors.

The permanent vines, from which no fruit is to be taken the following year, must be encouraged to make all the growth and foliage that can be fully exposed to the influence of light, as it is by this means that an abundance of roots will be formed, which in due course will send up vigorous fruiting-canes the second year. Therefore the laterals should be regulated and laid in, but not stopped until they approach the temporary vines, which they must not however be allowed to encroach upon. As the temporary vines progress, pinch the laterals at the first leaf, and stop the leaders at about nine feet from the starting-point. This will cause the young canes to strengthen, and plump up the fruiting-buds, from which a few bunches of grapes will be taken the following year, when the purpose for which they were planted will be accomplished. If, after stopping, one or two of the main buds at the top of the leaders break, allow them to grow on for a time, and give the sub-laterals a little more play as an outlet for the sap until such time as the canes become firm, and there is no longer any danger of the main buds breaking below that to which they will eventually be pruned.

The night temperature during the summer months, when fire-heat is at the minimum, may range about 70°, and it may run up to 80° or 85° on bright sunny days with a free circulation of air. With the increase of light and solar heat more atmospheric moisture as well as water to the roots should be given; but at all times avoid a close stagnant atmosphere when the weather is unfavourable to liberal ventilation. In giving air to the house admit a little at the top very early in the morning to allow the condensed moisture to escape before the sun has time to catch the foliage; then, as the heat increases, open the front ventilators; close early in the afternoon, and give a chink at the apex every night. As soon as the wood begins to ripen, increase the air, and gradually reduce the supply of atmospheric moisture; add a little more mulching to the roots to keep those near the surface moist, as vines should never be allowed to become dry, particularly at this stage, when spider is likely to put in an appearance, and the natural ripening of the foliage is of the greatest importance.

When the wood turns to a dark brown colour, all the ventilators may be opened to let in sun and air, the great consolidators of the summer's growth: the laterals may be taken out of the temporary vines from the base up to the pruning-bud, provided the main leaves have not been injured or destroyed, when one leaf must be left on the laterals; and the foliage may be occasionally syringed on fine evenings, to keep it clean and free from spider, until the wood

and roots are thoroughly matured. Some grape-growers prefer allowing their young vines to break naturally before they plant; but by planting early a march is stolen upon the summer, which may prove cold and unkind. The young canes have plenty of time to make and mature their growth before the end of August, when they have a good rest, and are in a suitable condition for early pruning, and an early start the following year.

The Second Year's Management.—*Pruning.*—If all has gone well and the foliage has fallen early in November, the vines will be fit for shortening back by the middle of December. As those intended to remain another year before they are allowed to carry fruit, have made two canes where they are five feet apart, and three canes where six feet has been allowed, pruning must be regulated by the space at command. In either case cut the main rod down to about nine inches below the top of the front light, and take off the side shoots as in Fig. 14, down to the lowest bud, *a*. If one rod only is to be allowed to grow up the second year, the bud, *c*, may be rubbed off when all have started, and the shoots, *a* and *b*, are considered safe from accidents. If two rods have been decided upon, then allow *b* and *c* to grow on and stop the shoots *a*, when they have made five or six leaves. Shorten back the supernumeraries, from which some six bunches of grapes are to be taken, to within about six feet of the front sill, and pruning for the second year will be complete.

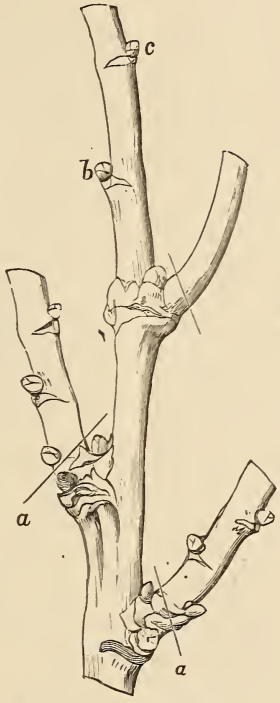


Fig. 14.—Maiden Vine ready for Pruning.

Immediately after the vines are pruned, apply styptic to every cut to prevent bleeding when they are again started into growth, and at once proceed to cleanse the house as well as the rods, preparatory to a fresh start early in the new year. As cleanliness is a very important item, let every part of the glass and woodwork be thoroughly washed with soap and water; also scrub the canes with a soft brush, and when dry, apply a solution of Gishurst compound, 8 oz. to a gallon of water, to destroy the larvæ of red spider or other insects which may be lurking in the loose scales at the base of the buds. Wash the walls with quick-lime, to which a handful of sulphur has been added, and sling the rods out of the way for the present.

Only a moiety of the border having been made, examine the retaining walls, and if the roots have reached the outside, fork down a small portion of the turf, and add the first three feet of the external border when the weather is dry and favourable to the handling of the soil. As it is by no means desirable to let this new compost become saturated with rain or snow-water, cover it up with fresh horse-litter, place shutters or lights over all, and allow them to remain until wintry weather has passed away. Next proceed to remove all old mulching and loose soil from the internal border; prick up the surface with a hand-fork, and make up to the requisite height with new rich compost, free from animal manure. If severe weather sets in after the vines are pruned, warm the pipes to keep out frost, otherwise keep the house cool and well ventilated until it is closed for forcing.

Where a set of houses has been planted for early, mid-season, and late grapes, it is the practice with some to start the earliest in February, and to allow the late ones to break naturally; but it is questionable if it is not better to start all of them in February with gentle fire-heat, than to be obliged to fire such late kinds as Gros Colmar and Lady Downes, to ripen up the wood in the autumn. Therefore, assuming that the buds are plump and promising, and all the preliminaries have been completed, give each of the fruiting vines one tie to the wire nearest the top of the front sash, then gently bend or arch it over inwards until the point of the rod nearly touches the surface of the border, and the least prominent buds at the base are raised to the highest part of the arch; secure it to a stick placed in the turf wall, and mulch with two inches of short horse-manure as prepared for a mushroom-bed. Shut up the house or houses, say on the 1st of February, apply fire-heat to prevent the temperature from falling below 45° on cold nights, and 50° when mild during the first month. Syringe three times a day to soften the buds, and if at hand fill in the unoccupied space intended for the next moiety of the border with fermenting leaves, or dung and leaves together. This will keep the house constantly moist, while it economises fire-heat, particularly if it is turned over occasionally and a few fresh leaves added when the fermentation begins to decline. As soon as

the buds at the base have pushed half an inch, and there is no longer any fear of the point buds running away with all the sap, raise them to a horizontal position, and when all are growing freely, tie them up to the wires.

A little extra attention to this matter of breaking young canes is time well spent; as buds that do not start form unsightly gaps, which cannot by any future management be filled up; or if they break weakly, the first set of spurs is ever afterwards weakly. In the management of temporary vines, like these now in question, a few dormant buds do not make much difference, as six feet of cane will always give as many grapes as supernumeraries ought to carry; but when we come to permanent vines, this matter should receive most diligent attention.

After tying up the vines, raise the temperature from 50° to 58° by night, and 10° to 15° higher by day, until the foliage begins to expand and the leaders are well on the move, then gradually increase the day and night heats, in exactly the same way as was advised for the management of the first year's growth. It must, however, be borne in mind that a night heat of 65° for Hamburghs, and 5° more for Muscats, is quite enough until summer heat favours a higher range with a minimum of fire-heat. As a rule the temperature by day ranges from 10° to 15° higher; but there is no rule so mischievous as a hard and fast line in the regulation of heat, irrespective of the external condition of our uncertain climate. Therefore, it is always safe to rest when days are dark and nights are cold, and force with plenty of bottled-up solar heat and brilliant sunlight when favourable conditions prevail. The atmosphere of the house should be kept sufficiently moist by sprinkling the borders and paths, by turning the fermenting leaves, and by keeping the evaporating pans full of water; but on no account must the pipes be syringed when they are very hot, as steam so raised is always injurious and sometimes fatal to the tender foliage.

As days increase in length, and the vines grow very fast, give them plenty of water at the mean temperature of the house. It is impossible for any one to say how often vines should be watered; but there is not much danger of over-watering them when growing in well-drained borders; indeed, vines having nearly all their roots in internal borders frequently suffer from the opposite extreme.

As growth proceeds, stop all the laterals that form on the young canes at the second leaf,-and stop the leaders as soon as they reach half-way up the south side of the house. As this stopping of the leading shoots will cause the main buds on the lower part of the stem that are to produce fruit next year to fill up. and the rods to become much stouter, see that the latter have plenty of play in the early ties, and give them more room where there is danger of the sap being impeded in its descent to the base. When the top buds break, again allow them to continue their course to the top of the house, and encourage a free growth of laterals, provided there is plenty of room for the full development and exposure of the foliage to the action of light; but on no account allow the laterals to become a tangled mass, as they do not benefit the roots, and often become the breeding-places of troublesome insects.

As the temporary vines, from which some six or eight bunches are to be taken during this—the second year—will require precisely the treatment that will be laid down for the permanent vines in the next or fruiting year, it will not be necessary to describe that here; suffice it to say they must be grown under restricted management, so as to prevent their growths from interfering with the fullest possible development of the permanent vines.

By the middle of August vines shut up in February will be fast taking on their ripening garb, a condition which will justify the removal of all the laterals from the base up to the pruning-bud. These should be taken out close to the bud, at the base of the main leaves, provided none of the latter have been in any way injured or destroyed. Should this be the case, these particular laterals may be shortened back to one leaf, as they will be of service in storing up sap to perfect the buds from which next year's crop of bunches will preceed. The house must now have an abundance of air by night and day, and the foliage may have an occasional wash with the syringe, for keeping spider in check, until it becomes of a bright nankeen colour and falls naturally.

It is needless to say that the grapes from the temporary vines should be used at the earliest convenience after they are fit for table, as late hanging will interfere with the autumn management; but if they are not wanted they can be cut and bottled, when they will keep for many weeks in an ordinary grape-room. When all the bunches have been cleared, these vines, hard as it may appear to the amateur, *must* be taken out bodily, to make room for the proper training of the laterals from the permanent vines in the fruiting year.

As the next year's management of the vineries will commence early in January, it may be well to conclude our remarks on this stage by saying that the vines intended for early starting should be pruned by the end of September or early in October, the strongest rods to six feet, and the weakest to five feet—lengths which will give quite as many grapes as they should be allowed to

carry. All lateral shoots formed on the previous year's wood should be pinched off to a single bud, as in Fig. 15 at *a*, and any loose bark removed, when they may be well washed with soap and water, and dressed with Gishurst compound, as in the preceding season—that is, if spider has put in an appearance; otherwise, the Gishurst may be dispensed with, as insecticides are of no use where there are no insects to kill. As the vines have as yet only three feet of internal, and a like width of external border, an additional two feet may be added to each side while there is yet time for the points of the roots to make fresh spongioles. If the drainage, as well as the border, is made piecemeal, add suitable widths of broken brick, then cover with turf, grass side downwards; use turf for retaining walls, and make up with good turfy loam, to which the usual quantity of bones, lime rubble, and other materials, which will sustain the roots after the fibre has gone, must

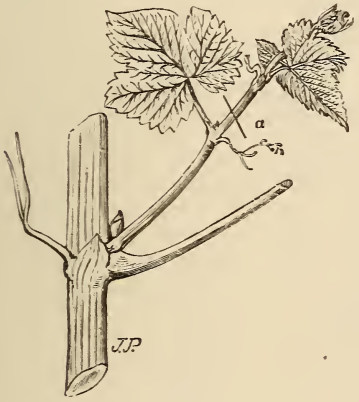


Fig. 15.—Stopping.

be added. Before making the addition, pick a little of the old turf walls away with a hand-fork; take the points off any strong protruding roots, to make them throw out more hard fibres; make up the new compost in a way that it will adhere to the old border, and cover the outside portion with plenty of fresh stable litter. Having cleansed the house thoroughly, wash the walls with quicklime and a little sulphur, top-dress the border, but defer mulching.

Third and Fruiting Year.—Having decided upon the period at which the vines under treatment shall give ripe fruit, the house should be shut up nearly, if not quite, six months in advance of that time—say on the 1st of January, to have grapes fit to cut in June—and so on for successional crops of early and mid-season grapes. The latest house should not, however, be allowed to remain inactive after the first week in March, as all winter grapes should be thoroughly ripe by the first week in September, otherwise much fire-heat will be needed to ripen up the fruit and wood, and even then it is very doubtful if the grapes will not begin to shrivel as soon as the leaves fall from the vines. Now, as this condition is fatal to the successful bottling of late grapes, and time, both at the beginning and end of forcing, is a most important consideration in laying on colour and finish, young maiden vines, which do not respond so readily as old ones, should always have plenty of time allowed to commence and finish their growth. Moreover, it is a well-known fact that three-fourths of the early grapes used in this country are cut as soon as they are black, or as black as they ever would be; but they are not ripe, and the first bunches bear no comparison to the last, a fair proof that time is of much consequence, at least where quality is the test of merit.

Therefore, assuming that the vigorous young canes which have been resting since the middle of October, with their points drawn down to the surface of the border, to equalise the sap and so help the lowest and least prominent buds forward, were shut up at the time mentioned, the first fortnight may be devoted to preliminaries, but no fire-heat will be needed unless the temperature falls below 45°, neither will ventilation be required. After that period, a minimum of 50°, with a rise of 5° by day, will suffice, with regular syringing, until the buds begin to break, when it may be gradually raised to 60° at night, with a rise of 10° from solar and fire-heat by day. At these temperatures, the house containing Hamburghs and varieties requiring Hamburgh treatment may remain until the shoots have run out three or four inches, when a further rise of 5° will suffice, until the grapes come into flower. Many people give Hamburghs a minimum heat of 70°, and Muscats 75°, when they are setting, but the roots being right, they will set just as well at 65° and 70° respectively, with a rise of 10° to 15° by day.

As bottom heat is of great importance, both in starting the vines and setting the fruit, some kind of material should be applied as soon as the buds begin to swell, to raise the temperature of the roots to about 60° or 65°. In wooded districts, where oak or beech leaves can be obtained, a good body of these placed along the front of the internal and external borders, and a few on the surface, will be found invaluable, as they give off a continuous mild moist heat, favourable to the swelling and breaking of the buds, and so reduce the necessity of constant firing and incessant syringing. Where borders are made piecemeal, as has been suggested, the areas left for the reception of future additions of compost

offer favourable positions for the fermenting material, from which warmth and ammonia soon find their way into the drainage, and produce more genial conditions than can be obtained from dry fire-heat, no matter how carefully the pipes may have been arranged.

Disbudding.—As soon as the young shoots get fairly on the move, disbudding must be commenced by the removal of all the weak side growths from each eye, leaving only one to furnish the fruit; and as more than one bunch must not be left on each break, all but that which appears to be the best may be removed as the work of disbudding and regulating the growths is proceeded with. By the removal of all the bunches that show on a lateral except one, and that the most compact and symmetrical, the strength of the vines is husbanded for a period when all their energies are brought into action through the stoning and later stages of growth. Having disbudded to a single shoot from each eye, the next question will be the removal of a certain number of breaks altogether, as overcrowding the spurs is quite as bad as overcrowding the young rods. Some defer this part of this very important operation until they can see the bunches; but as young canes five feet in length will always give plenty of fruit, it is better to rub off all that are not wanted before they attain much size. Therefore the first important point is the selection of a good leader, from which the bunches should always be pinched as soon as they can be seen; then will follow the removal of the side shoots, so as to leave those intended for permanent spurs about twelve inches apart all the way down the vine. It may be well to remark that great caution should be brought to bear upon the final disbudding or thinning, as any accident to one of the shoots left to form a permanent spur will cause a disfigurement which no after-management can remove.

Stopping.—The vines being five feet apart, a distance of two feet six inches each way may be allowed for the lateral growths; but as these will throw out sub-laterals, to be again stopped in their turn, the first stopping should be made at the second or perhaps the third leaf beyond the bunch. Soon after they are tied down, sub-laterals will begin to push. These, as well as the laterals on the growing leaders, must as a rule be pinched at the first leaf, and afterwards re-pinched unless there is a vacancy which requires covering; as every part of the trellis should be evenly covered with foliage, when the first sub-laterals may be laid into any convenient length. The leaders should be loosely tied every other day until they reach the top of the rafter, when they also must be pinched to strengthen the back buds from which the next year's laterals will proceed.

GENERAL MANAGEMENT OF VINES.

Setting the Fruit. — Preparations must be made for fertilising the bunches as the flowers open. A temperature ranging from 65° for Hamburghs, to 70° for Muscats, is quite sufficient early in the season: later on, when fire-heat is at the lowest, a few degrees higher may be advantageous, but this is doubtful. Recently scientists have pointed out that the pollen and the stigma in some varieties do not ripen at the same time, so that fertilisation cannot take place, and the action of foreign pollen becomes necessary. In some cases also the pollen is found to be inert. Herr Stefan Molnor, director of the School of Vine Culture at Buda-Pesth, has observed that "free setting" varieties of Grapes have the stamens erect, forming a cluster round the stigma, whilst "bad setting" varieties have the stamens deflected from the pistil. The kinds of grapes which require daily attention are Muscat of Alexandria and its allies, all the Sweet-waters, Black Morocco, Alnwick Seedling, Mrs. Pince's Muscat, and Lady Downes Seedling. When they commence flowering, the highest temperature given should be maintained, with a free circulation of air and atmospheric moisture in moderation on bright fine days. When the weather is dull and cold this may be reduced, but not entirely suspended. Some grape-growers fertilise with the syringe; but grapes which set with the syringe set equally well, if not better, with the camel-hair pencil. The middle of the day, when maximum heat prevails, is the best time to fertilise, and foreign pollen should always be used, of which there is none better than that from the Hamburgh. If a Hamburgh house is not likely to be in bloom when the kinds named are ready, a good supply should be secured in advance by shaking the Hamburgh bunches over a sheet of paper or into a small box, which can be put away in a dry place for future use.

One of the most difficult grapes to fertilise is Black Morocco, and as it is one of our best winter grapes, it should receive a little extra attention. If the flowers are closely examined, a viscid kind of substance will be found adhering to the pistil and the anthers, and so completely clogging those organs as to render natural fertilisation almost impossible. This should be removed by passing a camel-hair pencil over the bunches, then following with the pollen, when every berry will set as freely as a Hamburgh. Fig. 16 represents a neglected bunch of this variety, upon which nearly all the berries are seedless, and although they would ripen, the bunch would be worthless. In order to

prevent the condensation of moisture, a chink of air at the back and front of the house should be kept on all night, unless the weather is frosty, and the proper temperature cannot be maintained.

Some grape-growers fertilise their grapes by giving the vines a sharp rap with the hand to set the pollen at liberty; others trust to the natural energy of their vines and a brisk buoyant atmosphere; while others draw the hand lightly down the bunches when they are in flower, but this is a bad practice, as the pressure and moisture, however slight, often injure the embryo berries, notably of Muscats, which show a small brown spot at the points when they are ripe.

Thinning.—The art of thinning grapes well cannot be properly acquired without practice and a thorough acquaintance, not only with the different sections, but also with particular vines of the same variety. Take as an example the numerous varieties grown under the name of Hamburgh. Some produce loose bunches of medium-sized berries which require moderate thinning; others produce heavy-shouldered bunches, which set thickly, and produce large, short-stalked, hammered berries, half as large again as the first. Both are called Hamburghs, but directions for thinning the first would not apply to the second, and *vice versâ*. Lady Downes, Alicante, and Gros Colmar are three late kinds, which require totally distinct thinning to insure perfect clusters when they are ripe. When thoroughly acquainted with the peculiarities and capabilities of different houses of vines, a good practical hand can thin to a berry; but as no amount of writing can convey that experience, the subject must be here confined to general principles.

The best time to thin is as soon as all free-setting kinds are out of flower, and the berries approach the size of No. 1 shot. Muscats and shy-setting kinds should be allowed to get a little more advanced, and when those which are properly fertilised begin to take the lead, those left behind in point of size should, as far as possible, be removed, as stoneless berries never take the second swelling, and no matter how symmetrical a bunch may be, uneven berries greatly detract from its appearance.

When properly thinned, a bunch of grapes should contain as many even-sized berries as will form a compact cluster, well berried up to the stalk, and close enough to retain its perfect form when cut and laid on the dish. If the berries fall about and expose the stalks it is over-thinned; if they bind and force each other out of place it is under-thinned. Early and mid-season grapes that are insufficiently thinned do not suffer so much as late ones, which have to hang through the dead months, when a free circulation of air to prevent the berries from rotting is indispensable. As grapes should never be touched by the flesh or hair, either of which produces rust and destroys the bloom, the operator should begin at the point and work upwards, holding and turning the bunch with a small hooked peg. All the smallest and plenty of the inside berries should be taken at the first thinning, and the work should be carried on early in the morning and late in the evening, when the body is cool and the fingers free from perspiration. Fig. 17 on the next page is a fair representation of a bunch of Hamburghs after the first thinning. It is possible that a few of the berries left at the first thinning may not be perfectly fertilised; if so, they will be weak in the foot-stalk, small, and slightly transparent. These are the berries which should be taken out at the second thinning.

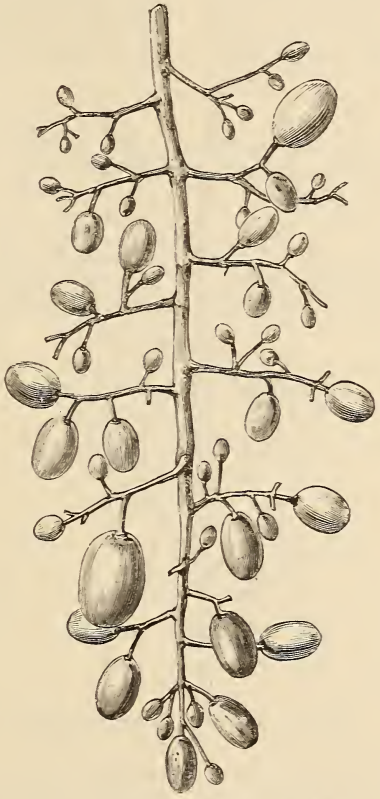


Fig. 16.—Black Morocco Badly Set.

Lady Downes and all the late kinds, including Gros Colmar, the largest of all grapes, should be thinned until there is no danger of binding: otherwise, all other points being satisfactory, their keeping for any length of time after the leaves fall will be very doubtful. The inexperienced, who have to feel their way, should make a point of going over

the bunches three times, the first time immediately after they are set, again after they are stoned, and finally to remove any badly-placed berries before they commence the last swelling.

As yet nothing has been said about the weight of grapes which a vine may be allowed to carry. If over-cropped the grapes often shrink or fail to put on perfect colour and bloom, without which they cannot be considered first-rate. Badly-coloured grapes never attain their proper flavour, and, notwithstanding the fact that a great number of bunches may have been left on the vine, while being second-rate in quality, will not in the aggregate weigh more than a reasonable number of bunches; when the quality, and, as a matter of course, the value, will be on the side of the smaller number of bunches. On the other hand, too light cropping, particularly in the case of vigorous young vines, is not recommended, as they are apt to get too strong and gross, when the proper maturation of the wood and buds becomes difficult and expensive. If the canes in question have made an abundance of healthy foliage, without which good grapes cannot be expected, one and a half pounds to every foot of rod will be a good crop the first year. If it is found that they make plenty of laterals throughout the stoning period, it may be taken for granted that they are not overloaded, when the crop may be repeated the second year, and so on, allowing one and a half pounds to a foot of rod so long as they make plenty of lateral growth during the time they are stoning.

Fig. 17.—Young Bunch Properly Thinned.

Moisture and Watering.—As soon as fire-heat is applied to the house, syringe the vines with tepid water three times a day. Keep the evaporating pans constantly full, and damp the floors and walls to prevent the atmosphere from becoming dry. Where fermenting material is used and frequently turned and sprinkled, it will be found a powerful aid; but alone it is not sufficient, as direct syringing is necessary to keep the bark on the stems, as well as the buds moist, until the most persistent break into growth. Early vines should be well syringed until the bunches begin to draw out, when, provided they can be kept free from spider, it may be discontinued until after the grapes are cut. Later houses, to which more air can be given, may be syringed until the bunches approach the flowering stage, and the damping of the old wood and foliage, where it can be done without wetting the grapes, may be resumed after they are set. Syringing, however, should not be carried on to an extent that will prevent the foliage from becoming thoroughly dry once in every twenty-four hours, otherwise it will be soft and flabby, small excrescences will form on the lower sides of the leaves, and a super-abundance of moisture, particularly through the night, will render them liable to scalding before it can pass off on bright mornings. It is needless to say the grapes should never be touched with water from the time they are formed, as the purest water contains matter in solution which invariably mars the appearance of the fruit, and in calcareous districts renders it unfit for table. When the grapes begin to colour, moisture must be gradually, but not suddenly reduced, and never entirely discontinued, at least in early and mid-season vineries. In late houses, where the grapes have to hang for some time after the leaves fall, a perfectly dry atmosphere is necessary, not only for the preservation, but also for the proper finish of the fruit.

Although watering has been previously touched upon, so important is this element that a few words here may not be out of place. It is very difficult to give precise directions for supplying water to the roots of vines. One thing, however, is certain—a properly made and drained border cannot easily be overwatered. Therefore, a liberal supply of water at a temperature of 90° should be given at the time the house is closed; another before the grapes come into

flower; a third, after they are thinned; a fourth, when they are taking their second swelling; and another when they begin to colour. All vines should be mulched—old vines at the outset, young ones after the fruit is set, for the twofold purpose of feeding the roots and securing an equal supply of water to every part of the border. Each watering after the grapes are set should be with diluted liquid, and the quantities should be sufficient to pass through the soil and drainage. In hot, dry summers, the external borders will also require attention. Many growers never think of watering the outside roots; but when it is borne in mind that they are confined in a porous compost, resting on liberal drainage, and that a broad expanse of foliage in a high temperature, and within a few inches of a glass roof, is constantly drawing up and giving off moisture, it may be readily imagined that a gross feeder like the vine will be none the worse, if it is not a great deal the better, for an occasional drenching with the hose. When vines are heavily cropped and perfect finish is doubtful, a good external watering through a liberal mulch of rotten manure very often turns the scale in favour of the grapes. The benefit does not, however, end in the production of jet-black grapes only, of which every grower is proud; it very often wards off attacks of red spider, which spreads rapidly and leaves its mark in years to come. The same rule applies to internal borders when colouring is doubtful. Often, very often, the old and pernicious practice of withholding water from colouring grapes ends in disappointment, when four inches of good diluted liquid, at a temperature of 80° to 90°, would stimulate the roots and produce the desired effect.

Immediately after the grapes are cut, the vines should have a good syringing with pure water to cleanse the foliage from dust and red spider, which may have made some progress. The inside border should have a good watering with tepid liquid to keep the roots moist and active until the foliage begins to ripen; and external borders, but too often neglected, will derive great benefit from another mulching of short manure to keep the surface moist during the autumn months.

During the time the grapes are hanging ripe, they should have a good canopy of stout, healthy foliage, evenly spread over every part of the trellis to protect them from the sun, otherwise black kinds will soon begin to lose their colour; while, on the other hand, white ones will be improved by exposure to light and solar heat, which can be admitted by the partial removal or turning aside of some of the laterals. After the grapes are cut, all laterals must be removed down to the main leaves on the fruit-bearing shoots, to plump up the buds to which they will eventually be pruned. It too often happens that these laterals are allowed to go on for a time; the vines, relieved of their crop, make a sort of supplementary growth when they ought to be going to rest, and persist in resting when they ought to be starting into another year's growth.

Ventilation.—Air should be admitted daily from the time fire-heat is first applied until the vines go to rest. In the case of vines started in January, it often happens that the weather is unfavourable to the admission of more than a chink at the apex; but be it much or little, a change of air should be secured every day by admitting it at as many of the ventilators as possible, in preference to causing cold currents from fewer places. As days increase in length, and the tender foliage begins to expand, admit a little air early in the morning to favour the escape of impure gases and condensed moisture, before the sun strikes fully upon the roof. As the sun gains power, increase it until the maximum is reached, then as gradually reduce and finally close in time for the atmosphere of the house to run up a few degrees in the afternoon. The temperature for vines in the different stages of their growth has been given in a preceding paper. The admission of air should always be so regulated as to favour a steady rise until the meridian is reached, and then, if necessary, it should be increased to prevent the house from getting too hot, but on no account should it be admitted in quantity that will cause a depression. Neglect of this rule is often very disastrous in early vineries—in fact, in late ones too; as the sudden admission of cold chilling air which lowers the temperature, checks the growth, produces rust on the berries, and so lays the foundation of a condition favourable to the attacks and ravages of insects to which the vine is subject.

During the stoning process, a period most trying to the vines, sufficient fire-heat should be given to secure a constant supply of air both by night and by day; and such kinds as Lady Downes and Muscats, liable to scalding, should have a steady circulation, if possible, passed over the hot-water pipes to prevent condensation of moisture on the berries. For some considerable time during this process, the grapes will not make any external progress; but when once this exhausting stage is passed, they will swell very fast, when more air through the early part of the day must be succeeded by early closing in time to run up some ten degrees above the maximum heat. After the house has been closed for a few hours to swell the berries, a little night air will secure that rest which is so necessary where vines are carried forward under high solar influence. When the berries begin to colour, a still further increase will

be necessary, as a free circulation of warm air is one of the main factors in laying on colour, and time is equally important in producing bloom and finish. But this must be so managed as to preclude all chance of a check or chill, and closing for a short time on fine afternoons must be indulged in to swell the berries. If the weather through the latter part of May is fine and warm, liberal ventilation will finish up the grapes in a satisfactory manner, when a lower temperature will be necessary.

PRUNING AND TRAINING.

Pruning.—The vine being a vigorous-growing plant, it is necessary to prune away the greater portion of the wood of the current year, not only to keep it within bounds and to carry out any particular kind of training, but also to concentrate its vigour in the buds which are left for producing new fruit-bearing wood the following year. As pruning and training may be said to go hand in hand, the mode of the one is governed by the other, the great object being the maintenance of a healthy condition of the vine under glass, and the production of the greatest weight of fruit which it is capable of bringing to maturity through a long succession of years. Formerly, the long-rod system was practised in every vinery, and it is still resorted to where shy kinds, such as Buckland Sweetwater, Barbarossa, and a few others, fruit best on rods of one year's growth. The method is that of laying in a number of young canes and pruning them to various lengths, so as to obtain fruit from the buds which they contain. During the time these rods are carrying a crop of grapes, others are being trained up to take their places after they are cut out at the autumn pruning. Fortunately for the amateur, this unsatisfactory system has given way to the close-spur system, which is as simple as it is successful, and may be performed by the uninitiated with the greatest certainty of a satisfactory result. But, in order to remove all doubt, it may be well to direct attention to the annexed figures, which will illustrate at a glance the method which ought to be followed, from the planting-rod to the fully-established fruiting-cane, when spur-pruning becomes simply a repetition of the system of cutting back to a single bud.

Fig. 18. — Spur of One Year.

It may be well first to refer back to Fig. 13, page 235, showing the yearling cut back ready for planting; also to Fig. 14, showing the young vine at the end of its first year's growth. Fig. 18 is a vine-stem showing spur of one year's growth. Here the lower spur (1) is properly pruned; the upper spur (2) is badly pruned. Fig. 19 shows a badly-pruned spur of the second year; while Fig. 20 shows a spur of the same age which has been properly pruned.

The great secret of success consists in pruning every year to a single bud, as in Fig. 18, No. 1, which keeps the young growths near home, while No. 2 in the same figure results in long ungainly spurs, which soon become unsightly and have to be removed, as shown by the lines in the figures.

Many good grape-growers are afraid of losing or damaging their crop by pruning back to a single bud, but if the wood is properly ripened there need be no fear of their not showing fruit, and that of the best quality, as the bunches from the lowest buds are generally more compact and produce finer berries than those from more prominent eyes farther away from the main rod. When two or three eyes are left, the most prominent invariably starts first (see Figs. 19 and 20), and the lower buds break weakly or not at all. The strong break shows plenty of bunches, the weaker breaks are rubbed off; and so the mischief goes on, until the unsightly spurs are obliged to be cut away, when the adventitious buds at the base break and form new spurs, but, it must be remembered, at the expense of a crop, as the buds from these breaks rarely show fruit the first year.

Fig. 21 shows the properly pruned spur when it is three years old, an age at which it will throw out one, two, or three shoots. The strongest and best-placed is selected for fruiting; the others may be rubbed off, or sometimes one may be pinched to form the base of a new spur, when eventually the old one can be removed.

Shortening the Rods.—If the fruiting-canes were left five feet in length the first year, from three to four feet of young wood will be sufficient for the second year, and so on, until the rod is formed and properly furnished with spurs up to the top of the rafter. If, as was directed, all the summer laterals were taken off in the autumn, from the base up to the pruning-bud, the leader will simply require shortening back to the required length, according to the strength of the vines. Some leave more than the three or four feet here recommended, but bold shortening is always safe, as it throws strength into the lower spurs, and every bud on the leader breaks with vigour; whereas a greater length of rod very often breaks weakly at the base, and so

leaves a defective piece of stem in the middle of the house, which no after-management can rectify. When the first cane is regularly furnished with spurs from the base to the apex of the house, a second rod should be started from the base; and when it also approaches the top, a third may be started from the opposite side of the original cane, where any particular vine or favourite variety, by its vigour or superior quality, shows that it is worthy of extension. But as the space allotted to each vine as soon as the leaves fall, and the late houses which shed their leaves before the fruit is cut, should be pruned as soon as the grapes are removed. The vines in late houses do not often bleed when the sap begins to rise; those in early houses do; hence the importance of dressing every cut with styptic as the work proceeds, as bleeding weakens the vines; and so powerful is the vital force, that the most stringent styptic fails to arrest it, if dressing is neglected until the sap is again on the move.

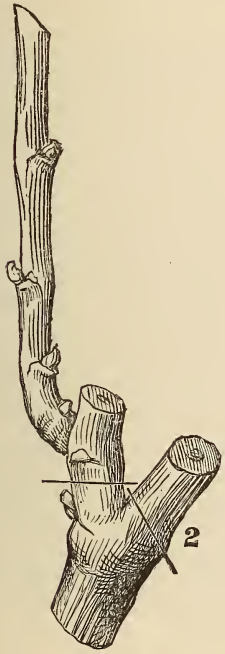


Fig. 19.—Badly Pruned Spur of the Second Year.

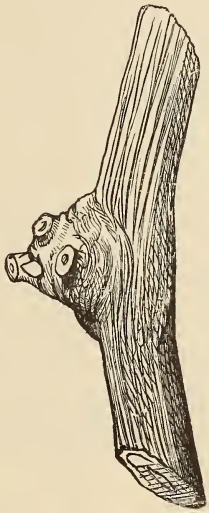


Fig. 21.—Three-year-old Spur Properly Pruned.

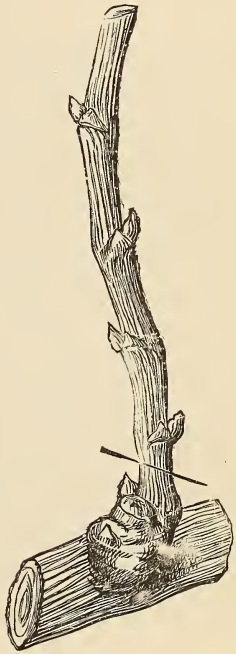


Fig. 20.—Spur of the Second Year Properly Pruned.

will not admit of laying in these canes without overcrowding, one or more of the least satisfactory vines can be cut away altogether, to make room for carrying on this modified system of extension training. In this way a house may be gradually filled with a few of the best vines, without at any time having any part of the trellis bare of fruit or foliage.

The time to prune must be regulated by the time the houses are to be started. The house that was started on the 1st of January the first year, if intended for early work, may be started on the 1st of December in the following season, and the house intended for succession that was started in February the first year, may be shut up on the 1st of January in the second year. These houses should be pruned

Extension Training is a combination of the long rod and spur systems, and consists of allowing one vine to grow on from year to year until it occupies a large portion, or perhaps the whole of a house. Many good growers, who do not altogether approve of the principle, admit that extension is favourable to longevity, as many of the oldest and finest vines in the country have been trained in this way; and all must admit that, as regards quantity and quality of the fruit, the system has many points in its favour. Some go so far as to say extension training should *not* be practised where the natural soil is unfavourable to the roots when they get out of the prepared borders, and are no longer under control; but this is a mistake, as the yearly spread

of the new wood and foliage forms one of the best safe-guards against shanking, while the crop from vines so trained is greater than that produced by a series of vines occupying the same space. The extension system is well adapted to large, lofty span-roofed houses running from south to north, as the vines can be planted at either end, and trained horizontally under the ridge. These leaders should be shortened back at each pruning to four feet for one pair of arms or rods, which will run down to the eaves, and to eight feet for two pairs of rods where rapid growth is desirable. These rods, in their turn, should be shortened back to any given length, when the buds left on the young wood must be thinned out, and the fruit-bearing laterals cut back to a single eye, exactly the same as advised in close spur pruning. So long as the vine has room to extend, the bunches from the young wood run to a very large size, and the berries of the Hamburgh swell up much better than they do on vines under repression. Moreover, all the arms being taken from the main horizontal rod, which occupies the highest part of the house, to the eaves, the sap is checked in its downward course, and the strength of the growths is equalised. It is scarcely necessary to say that extension training is not favourable to early forcing, as the roots cannot be so readily warmed and protected through the winter months; but for mid-season and autumn crops, it offers one of the most simple methods of growing first-class grapes. There is, however, no rule without exception; as the famous old vines at Cole-Orton, which kept the veteran grower and exhibitor, Mr. Henderson, so many years to the front, were grown upon the extension principle; but instead of cutting back to a single eye, he always pruned to a prominent bud, and laid in as much wood as would keep every part of the trellis furnished with foliage. A vine which fills the early house at Eastnor Castle is trained and pruned upon the Cole-Orton principle. It has been forced for early grapes without intermission for thirty-five years, and still produces excellent fruit. The vines at Cole-Orton are on the coal measures; the roots of the vine at Eastnor have the run of external and internal borders, and are under control.

THE FLOWER GARDEN.

By William Wildsmith.

SUCCULENT BEDDING.

UNDER the heading of Succulent Beds we class not only the cultivation in beds of all kinds of plants having thick fleshy leaves and stems, such as Agaves and Echeverias, but also the many varieties of Sedums and other mossy or "tufty" growing plants, which harmonise with the quaintness of appearance of the great bulk of succulents when arranged in conjunction with them. That these are a very desirable class of plants to cultivate for summer bedding, may be gathered from the admiration and praise they excite among the crowds that surround arrangements of them in the London parks. This class of admirers may not always be the best judges as to taste; but still arrangements that afford such pleasure to the multitude are worthy of adoption on that ground alone. But there are other reasons for the extended culture of this class of plants as summer bedders, not the least being their immunity from injury by storms and rain. They are also effective immediately after they are planted, and their quiet beauty greatly enhances the general effect of every other style of planting in the same garden. They also do well under the shade of trees or hedges, where other plants would dwindle and die, and yet they will bear the full sunshine with impunity. All these are surely good reasons why they deserve to be used more largely than they are. Such objections as formal, artificial, "cockle-shell-like," have been urged against their use; but this is a matter that rests entirely in the hands of those who arrange them, for they are just as amenable to the producing of informal and harmonious mixtures as are any other class of bedding plants.

Having named reasons why they should be used, we must, however, add that on no account should ordinary bedding-out plants, such as Pelargoniums and Ageratums, be mixed up in the same bed with them. Alternantheras are about the nearest approach as to mixtures that should be made. These look fairly well as ground-works for the taller succulents, but there are so many dwarf hardy plants so much more suitable, that there is no necessity to use even these.

Arrangements.—The most pleasing way of arrangement is that of a large circular bed, beginning from the centre, with a tall plant of *Yucca aloefolia variegata;* then three plants of the tree *Sempervivum arboreum;* then six plants of the tree *Sempervivum phylloides:* then six plants of *Sempervivum arboreum variegatum*, alternated with six plants of *Sempervivum Canariense;* the next circle being nine plants of *Echeveria metallica*, and nine of *Sempervivum Haworthii*, also alternated; the outer line next the edging being twelve plants of *Echeveria glauca metallica*, and the same number of *Echeveria farinosa;* the outer edging being *Sempervivum calcareum* and *Echeveria secunda glauca;* the central portion of the bed being clothed with the flowering mauve-coloured *Mesembryanthemum con-*

spicuum, and the outer portion with *Mesembryanthemum cordifolium variegatum*. This arrangement we have proved to be in all respects most pleasing and lasting.

A more formal arrangement, which, under certain conditions as to place and surroundings, is sometimes desirable, is as follows:—A circular bed of medium size, and at the outer edge divided into six parts or points, from each of which draw a semicircle, the six recesses thus formed being edged with *Kleinia repens*, and the outer circular edge with planted in regular mixture the smaller class of succulents, such as *Echeveria Peacockii*, *E. farinosa*, *Kleinia tomentosa*, and as standards the variegated *Sempervivum arboreum variegatum*, the carpet of margin being *Sedum corsicum*, grey. From this flat margin the soil is gradually raised in the mound-shape shown in the illustration, and at regular intervals are planted standard succulents, the centre being *Yucca aloefolia variegata*, and the other large ones *Sempervivum arboreum*, *S. Hendersonii*, *S. urbicum*, *S. canariense*, *Echeveria metallica*, and *Agave ameri-*

Succulent Bed at Heckfield Place, Winchfield.

Echeveria secunda and *Sedum glaucum*. In the centre of each recess put a large plant of *Echeveria glauca metalliea* and *Agave americana variegata*, alternate, surrounding the Echeverias with *Pachyphytum bracteosum*, and the Agaves with *Echeveria Peacockii*, filling out the recesses in which are the Agaves with *Sedum corsicum*, and the others with *Sedum aere elegans variegatum;* the points formed by making the recesses to be filled out with *Kleinia repens*, and the central part of the bed with tall succulents, after the manner advised in the first arrangement, the undergrowth to be either *Sedum Lydium* or *Herniaria glabra*.

An arrangement for a large bed is that shown in the illustration. This bed is fifteen feet in diameter, and has a raised edging of *Herniaria glabra;* then a flat margin fifteen inches in width, on which are *cana variegata;* the intermediate spaces being filled in with any kinds, after no particular order, except to fill out the space evenly. The undergrowth of the inner portion of the bed is the small mauve-coloured-flowered *Mesembryanthemum cordifolium*, and the outer the variegated form of the same plant. The somewhat formal arrangement of the outer portion of this bed is due to the fact that the surrounding beds are of a geometrical description; therefore, a very gradual departure from that mode of design was necessary to make the two styles harmonise.

Though we have never been able to recognise the practice of mixing up succulents with ordinary kinds of bedding plants, such as Geraniums and other flowering kinds, as consistent with good taste, yet we have used them with good effect in carpet bedding patterns, as central and marginal plants for the

designs—the small-growing kinds being every way excellent for this purpose, and harmonising well with Alternantheras, green, grey, and golden Sedums and Saxifragas, *Antennaria tomentosa*, and moderately so with Gold Feather Pyrethrum. Occasionally we have arranged the outer portion of a succulent bed in carpet bedding style, using the brightest Alternantheras, &c., but dotting, in the carpeting plants, more than the usual number of small succulents, thus, as it were, leading gently up to the sombre succulent mixture. This marginal bright band arrangement to succulent beds, meets with the approval of the majority of visitors; but personally we prefer the more lasting beauty produced by using succulents only in the same bed.

These examples will sufficiently illustrate modes of arrangement. Of course the style is only adaptable to large gardens, where every description of bedding out is required to be done, and that have convenience for raising and wintering the plants. Flowers will be, and ought ever to be, preferred for small gardens, but those having large gardens should certainly have some portion of them planted in succulent style.

List of Plants available for succulent bedding, together with those that make appropriate ground-works for the same. These last we place first; they are—*Antennaria tomentosa*, *Cerastium arvense*, *Echeveria*, all the small-growing kinds; *Herniaria glabra*, *Kleinia repens*, *Leptinella scariosa*, *Mesembryanthemum cordifolium variegatum*, *M. conspicuum*, *Sedum glaucum*, *S. Lydium*, *S. corsicum*, *S. acre elegans variegatum*, *Sempervivum montanum*, *S. hirtum*, *S. tabuliforme*, *Saxifraga Aizoon*, *S. rosularis*, *S. hirta*, *S. pectinata*, and *Veronica rupestris*.

The best tall and large-foliaged kinds are—*Agave americana* and *A. americana variegata*, *Cotyledon pulverulenta*, *C. tomentosa*, *Echeveria metallica*, *E. glauca metallica*, *E. agaveoides*, *Kleinia tomentosa*, *Pachyphytum bracteosum*, *P. Hookerii*, *Sempervivum arboreum*, *S. arboreum variegatum*, *S. sanguineum*, *S. canariense*, *S. Hendersonii*, *S. phylloides*, *S. Haworthii*, *Yucca aloefolia variegata*, *Y. filamentosa*, *Y. recurva*, and *Y. gloriosa*.

Propagation and General Culture.—Nearly all the kinds enumerated throw offsets freely from the base of the plants during the summer; these may be taken off at any time, and be inserted in pots or cutting-pans in an open sandy soil, and if put on a shelf in an intermediate temperature, with full exposure to the sun, they will quickly make root. Kinds that do not throw offsets freely are represented by *Echeveria metallica* and *Sempervivum arboreum variegatum*; the latter strikes freely from cuttings, and the *Echeveria* from leaves. The cuttings require exactly the same treatment and temperature to strike as do the offsets, but the leaves of *Echeveria* should have a stronger heat. The mode of layering these on the pans of open soil is as follows:—The midrib of the leaf having been partially cut in several places, the bottom part should be put in the soil, then the whole leaf be pegged *on* the soil, especially taking care that the midrib is bedded in it, as it is from this that the plant will be formed. Keep nicely moist, but not saturated. This mode of striking is rather a slow one, but sure, and one leaf will frequently throw as many as nine plants. *Pachyphytum bracteosum* and *Echeveria Peacockii* may also be increased in the same way.

All the small kinds throw offsets freely, and the hardier ones winter safely on a dry sunny bank, in which position they may be planted when first taken off. If large plants are desired, the old ones should be lifted before severe frost occurs, though, as a rule, early-propagated young stock will be found to get sufficiently large by the following season's planting-time, and the extra healthy appearance of such young stock will far outweigh any advantage to be derived from the larger old plants.

But few words are necessary as to culture. Succulents all prefer a light, open, and sandy soil, and abundance of drainage, and to be kept on the *dry* side as to watering at all times, but particularly during the winter. The beds in which they are to be planted should have the soil prepared on the same principle—that is, plenty of drainage, and if at all heavy, charcoal, brick, and mortar rubble may be intermixed with it. The only labour required after the plants are put out, is the keeping of the ground-work plants in position, and the flowers picked off those kinds that produce them, which is virtually no labour at all. The attention required by succulents is thus in singular contrast to that needed by every other branch of bedding-out.

THE ROSE AND ITS CULTURE.

By D. T. Fish.

THE PLANTING OF ROSES.

THE process of planting naturally divides itself into the time, place, and mode of planting. The question of what Roses to plant will receive separate treatment. That every one having a yard of ground to spare will desire to plant one or more roses in it is taken for granted, for a garden without

Roses is like a sky without a sun, or the midnight heavens with all the stars gone out. As Leigh Hunt sweetly sings :

> " We are blush'ing Roses,
> Bending with our fulness
> Midst our close-capped sister buds,
> Warming the green coolness.
>
> " Whatsoe'er of beauty
> Yearns and yet reposes,
> Blush, and bosom, and sweet breath,
> Took a shape in Roses."

The Time to Plant.—This is without controversy the six weeks included between the middle of October and the end of November. Within that period of grey mists and yellow fogs, when all nature as well as so many men seem about to fall into a state of semi-sleep, the roots of plants seem unseasonably active and ready to start into new ground with headlong alacrity and despatch. Hence the common saying, "Move a Rose in November, it *must* grow; transplant it afterwards, it *may*," is verified by the widest experience of practical results.

There are also several reasons more or less obvious for this more safe and satisfactory result of early planting: the earth is warmer than it is at a later period, and the descending sap has not yet ceased to descend. Either of these is most favourable to the emission of roots, while the two combined are the most powerful factors in their rapid production.

As the season declines the heat of the earth becomes of more cultural importance. During summer hardy plants like Roses are more likely to suffer from an excess than any deficiency of terrestrial heat. But in the late autumn or winter it is widely different, and it not unfrequently happens that Roses are killed through their roots, by extreme cold that their tops have withstood with impunity. Freshly-disturbed roots are more apt to be injured by frost than such as have not been moved. They are mostly nearer to the surface, and are more or less weakened for the time being by being detached from the soil. In cold soil the isolated wounded root lies almost dormant for a considerable time. But warmth is not only a heater but a quickener, and with a sufficiency of heat in the soil, the root-rest is of the shortest duration. Once fairly started, the Rose or other plant may be said to be safe, provided the new growths can be protected from destruction. The two most destructive agents being cold and motion, the plants must be rendered immovable, and the roots covered thickly enough either with soil or litter, or both, to prevent their being frozen.

Influence of the Descending Sap on the Formation of Roots.—This is more potent than that of the latent heat of the ground, for it is one among the many chief functions of such sap to strengthen old and form new roots. Whether the sap falls through a lack of vital or solar energy, by the operation of the law of compensation or of gravitation, matters not to our present contention; that it *does* descend in the late autumn or early winter is all that concerns us here. The period of its fall lasts from the moment the leaves and stems have reached full maturity, and for practical purposes it may be assumed that it continues to descend until the last leaf falls through over-ripeness or a notice to quit from the expanding growing bud in its axil, and possibly for some time afterwards.

Without going into the philosophical or scientific differences and functions of the ascending and descending sap, it may be broadly affirmed that the former is but little thicker than water, and the latter is little less than the Rose-plant in a state of fluid. The descending sap is the great builder, up or down, and solidifier of vegetable tissue. Its healing and stimulating properties are marvellous. Hardly does it reach or touch a wounded root than it heals it, and before it is fairly healed the descending sap forces it into new growth. Hence the descending sap is the tide in the affairs of the newly-planted Rose-tree, which taken at the flood leads on to fortune, fame, and a higher life of beauty and fragrance than before. All this has been so often verified by experience that it may be accepted and acted upon as a specific for the safe planting of Roses. In all respects November is better than any later month or day for the planting of Roses; and probably for many species of Rose, October is better than November. The days are longer, the earth warmer, the air, as a rule, more moist, and the plants themselves are endowed with greater recuperative forces.

Special Times for Special Varieties.—The above remarks apply with most force to Provence, Damask, Moss, Climbing, Briar, and Hybrid Perpetual Roses. Tea Roses, and Roses in pots, may be planted at almost any time and season. But in forming fresh beds or borders of Tea, Noisette, Bourbon, China, or other such tender Roses, the best season for planting is the end of May, or in cold localities even the first week in June. The Roses have thus all the fostering warmth and moisture of a long summer before them, and long before the end of the growing season will have grown strong, and if fair plants when put out, blossomed freely. So rapid is the growth of such Roses, and so freely do they bloom, that some have recommended planting them out annually in May, and lifting them at the end of October. They may be successfully grown in this way, though still better by being properly protected out of doors.

Could one insure a week's dripping weather towards the end of June, the majority of Hybrid Perpetual Roses might be safely re-planted, if necessary, so soon as their first flowering season was over. The Roses have thus a sort of breathing-time or interregnum between the finish of one set of flowers and the start for a second. At this stage there is a mixture of autumnal and vernal conditions. Some of the sap seems descending, while another portion is preparing to ascend, and it is found by direct experiment that Roses transplanted at midsummer re-root with exceptional celerity.

Roses will also grow, and sometimes thrive well, planted at any season from October to May.

Some Rose-growers even profess to prefer spring to autumn planting, their favourite months being February and March; the latter being, as a rule, the most unsuitable month in all the twelve for any planting whatsoever. But should genial weather ensue, and a little extra care be given, spring planting often proves fairly successful. It has this advantage, that in forming new Rose-beds or rosaries, the ground may be prepared easily in the autumn, be trenched up, and mellowed throughout the winter, and prove tolerably sweet as well as fine by the end of March, when the planting may take place.

What is called the summer planting of Roses mostly applies to those in pots, and may be continued throughout May and June. Exceptional circumstances may also compel the rosarian to plant at these or still more risky times. But all these seasons may be looked upon as exceptional times for planting, and the success that has attended them in no way lessens the force of all that has been urged in favour of planting Roses in general in the last weeks of October and all through November.

Place to Plant.—This resolves itself into the two questions of site and soil. Fortunately Roses are not very particular as to either, or rather it would be more correct to say, that in the rich variety of Roses there are those that will thrive on any site and in any soil. On the other hand, it is equally true that no site nor soil can be too good or too fostering for the best Roses. Where individual excellency of bloom only is desired, there is no better place than a portion of the kitchen garden or farm-yard, where the rich manurings, surface mulchings, heavy floodings with sewage, all so needful or useful to the development of perfect Roses, may be given *ad libitum*, without interfering in any way with the daintiness of the flower garden, or the charms of the well-kept lawn.

Southern, south-eastern or south-western, and western sites or walls will be found the best for the more tender Tea, Noisette, and Banksian Roses. By planting some of the hardier of these classes in colder sites, the succession of bloom may be greatly prolonged, and the character of the flowers of several varieties so altered, enlarged, and improved, as hardly to be recognised. For it is quite a mistake to assume that Roses cannot have too much heat or sunlight. Not a few of our finest Roses may be speedily burnt out of all true character and condition. For example, very few of our dark Hybrid Perpetuals can maintain their high condition on a south wall. Even a southern site in many localities, especially if on a slope, is far from being the best for Roses; and some of the finest ever seen have been grown on northern and eastern aspects. Of course, when grown in fields, Roses have to take their chance as other crops; but in such cases a considerable choice of sites is often possible, and many artificial expedients, such as shelters and shading, are used to preserve or more fully develop the qualities of the flowers.

The most perfect site or situation for a bed, border, or garden of Roses should marry the three S's—sun, shade, shelter—to air.

Sunlight and heat must be ample without being excessive. From dawn to noon, or from noon to dark, is as much direct sunshine as any Rose or class of Roses know what to do with. Even considerably less than this will prove ample for all sorts and conditions of Roses under the cloudless skies and baking heats of June. The morning sunlight is, on the whole, the best and least exhausting for Roses; though if they are so placed that little direct sunshine touches them till noon, the charms of dew-diademed roses may be much longer enjoyed.

Shade is almost as needful as sunshine. It preserves the colour and prolongs the existence of the blooms, and enables them to be better seen and more delightfully enjoyed. The brilliancy of masses of Roses in the full glitter and glare of unclouded sunlight is more overpowering than satisfying. Hence the true lovers of Roses are found lingering among them at dewy morn and quiet eveningtide. It is at such times only that the full beauty and fragrance of Roses can be revealed. Deep refreshing shade brings with it witching times among the Roses, whence the many attempts, by the skilful choice of natural sites, and by building walls and planting screens, to produce or prolong the season of shade among them. In all these artificial attempts to produce shade, nothing must on any account be permitted to approach too closely to or overhang the Roses, so as to infringe upon our last condition of a good site—a free circulation of air. In addition to the providing of shade for Roses in the mass, and for the purpose of the higher development of their beauty, and the more pleasurable enjoyment of the same,

individual flowers are often provided with local shading of a denser character for show and other purposes.

Shelters.—These are so closely related to shade that one contrivance mostly serves for both. Some amount of shelter, either natural or artificial, is almost essential for Roses. Neither their leaves nor flowers are moulded in such forms, nor cast of such hard materials, as to fit them to withstand the battle of the breeze frequently repeated. Hence it is downright cruelty to Roses to plant them in the teeth of the wind, blow from what quarter it may.

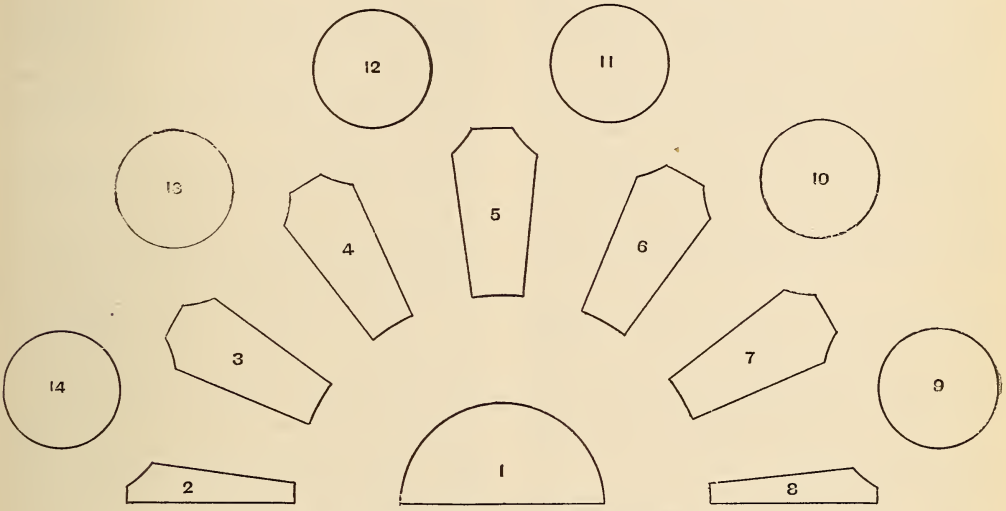


Fig. 25.—Rose Garden for a Rising Slope.

It is a painful sight to mark the distressed, bruised, ruined appearance of the ragged regiments of Rose-trees after such ill-matched encounters. Shelters must be posted round our sites to prevent such wreck and ruin.

In many places naturally sheltered spots may be found for Roses. In all, some may be formed. Mounds of earth, crowned with shrubs or trees, or with dwarfer growths, are among the cheapest, most ornamental, and natural-looking of all shelters. Walls or fences from six to ten feet high are the next best. Walls are expensive, but then the surface may be clothed with Roses or fruit-trees, both of which have an economical as well as an artistic and æsthetic value.

Fences, or hedges, are not so expensive. These may be formed of Roses, Beech, Maple, Hornbeam, Holly, Laurel, Yew, Evergreen Oak, Arborvitæ, Cupressus, Scotch or Spruce Fir, or other quick-growing dense evergreens, or rapid-growing shrubs or trees; Box, where it grows rapidly, being one of the best, as well as the more robust and choicer species and varieties of Rhododendrons. Any of these placed at proper distances, and planted in or grown into considerable mass, would provide sufficient shelter without an atom of overhanging shadow. It is by no means necessary that these shelters should take the form of straight lines, or formal hedges. On the contrary, their efficacy, as well as their beauty, would be greatly augmented were the outside, at least, to swell out into bold projections here, and recede there, and so on all round, thus fringing the rosary about with a band of verdure and warmth, the shelter being made thickest where the prevailing winds were the most fierce and frequent. Such living shelters would break or sift out the force from the fiercest winds on their passage through, so that by the time they reached the Roses, they would be unable to bruise a leaf, or tarnish the most delicate flower.

As the tops of our living shelters must on no account overshadow the Rose-trees, and rob them of their due quota of light, dew, or rain, so neither must their roots be allowed to burrow under the beds, and thus empty their larders of food. The old saying that roots and tops run a neck-and-neck race, each keeping abreast, and both covering the same distance, has much truth in it. But in the near proximity of the many rich and good things put into Rose-beds, the roots will be found far to outstrip the tops of many trees, and to have stolen

much Rose-food by stealth, while the tops are coyly moving their boughs many clear yards away.

The Best Soil.—Without controversy this is a strong holding argillaceous loam, so tenacious as to almost touch clay in some of its more inviting forms. To understand this more fully it may be added that not a few soils that are called plastic clay when wet, grow into strong loam when dry. Though such loams are, on the whole, the most favourable for the perfect cultivation of Roses, it must not be hastily asserted that they cannot be grown on others. The writer has seen prize Roses grown on loam so light that it could be driven and drifted like sand in times of protracted drought, and also on sheer peat. The mere natural quality of Rose soils is often of less vital importance than might at first sight appear, inasmuch as in very many cases the soil is the mere shell, dish, or basin to hold the savoury materials which are so freely given to Roses to feed upon. By such expedients not a few very poor and indifferent soils have been made to produce Roses equal to those grown on soils so good that expert rosarians have said of them that they seemed made for Roses. It may also be affirmed in general terms that land which will yield good wheat, beans, and mangold, will grow first-rate Roses. This has been proved over wide areas of late years, as the insatiable demand for Roses has impressed many of these into Rose nurseries, which have in some cases been planted with Roses without further preparation, and in others after heavy manuring and double-digging. The results have been satisfactory in both cases, though not equally so.

While saying this much, so that few may despair of growing fair Roses with soils such as they have, or can make with the materials within reach, it should be added that no loam can be too good nor too rich for the well-doing of Roses. Were it not for the expense involved, wherever a rosary or a Rose-bed is required on light gravel or sandy soil, such soil should be bodily removed to the depth of between two and three feet, and the space filled up with the top spit of strong fibrous loam from the nearest fat pasture or meadow. If the pasture is not fat, then the lean may be enriched, in the filling up, with a liberal sprinkling of smashed bones, night-soil, or manure; the two latter partially decomposed by age, or separated and weakened by an admixture of earth, are thus converted into specially rich and friable composts.

But it is seldom that such radical and expensive transpositions of soil are needful.

The Rose, whilst preferring these holding loams, manifests no reluctance to run freely and far into mixtures; and strength as well as friability and porosity seem often to be born of these admixtures. Two bad soils compounded skilfully will not unfrequently result in a good one. To give an extreme example, neither pure clay nor silver sand will grow Roses to any good purpose. Convert these two into one, by compounding a half-and-half of each, and the compound will at times almost rival the model loam already described; and so of many other soils and subsoils. Separated they are comparatively useless for Roses; combined, and further enriched by manures, they furnish all that is needed to grow Roses successfully. Thus heavy dressings of clay or marl on peat or sand; chalk or lime, or sea or other sands on clay; a few loads of ditch-mud and strong loams on gravel, of additions of subsoil to surface, and *vice versâ*, have all been fruitful in such transformation of texture and feeding qualities of soils, as to force those which were hopelessly inert or barren before to grow a garden of Roses ever afterwards.

Most of those admixtures of earth were accompanied by liberal dressings of manure. Not a few of these have been so liberal as to justify the comparison of the soil to a mere shell for holding the kernel, and in not a few cases the mere mechanical effect of so much manure on the textures of the soil has probably been of as much or even more benefit than their chemical constituents or feeding properties. For their mechanical influence in the amelioration of soils, few manures equal that from the farm-yard. It is a sort of *omnium gatherum* of most of the more valuable animal and vegetable manures. Any excess of it, however, on light soils might tend to make them get lighter, and consequently more unfit for Roses. But on heavy soils no manure can match it, and the heavier the soil, the heavier the dressing may be.

The Ameliorating and Enriching of Rose Soils.—Among other alterative, ameliorative, and enriching appliances of Rose soils, the following are the best: burnt chalk, clay, loam, or other earths, charred refuse of all sorts, charcoal, and lime or builders' rubbish, smashed bricks, bones, ashes, town refuse, road-scrapings, street-sweepings, spent tan, spent hops, malt, malt-combs, night-soil, and the dung of cows, pigs, fowls.

Few things afford stronger proofs of the omnivorous character of Roses, and the painstaking care of rosarians in supplying their wants, than this list of food, which might indeed be considerably extended, so as to include the whole of our natural and artificial manures.

The mechanical effects of several of these substances are almost permanent, those of others more or less temporary. Of the first class are burnt earth

and charred refuse of all sorts, including the earth, which should be rather charred than burnt for such purpose. In the former case the flame, when any, is smothered in by constant additions of fresh soil; in the latter it is allowed free course. The enrichment may, to a great extent, be measured by the thoroughness of the admixture. One ingredient provides what the original soil might be wholly deficient of; another sets free what was so securely locked up in the close-grained texture that even the subtle searching roots of plants could not get at it. The effect of the manures is more transitory, but often almost immediate in their action. So much is this the case with some of them, that literally the wilderness of yesterday or of last year is made to rejoice and blossom with Roses only a few months after planting. The Rose is what is termed a gross feeder, and it well deserves the character. Hence, however rich or varied the materials of its root-runs, it speedily empties and exhausts them. While the necessity of replenishment, and the means of accomplishing it, will be considered under cultural heads, it may be well to state here, to prevent disappointment, that the frequent transplanting of Roses seems needful to maintain them in the highest health, and to keep the individual bloom up to first-prize standards of excellency.

Depth of Rose Soils.—Here the mere truism must be duly noted, that the deeper these are the longer the Roses will last. Two feet is a good average depth for Roses, but three is better, and even four, where attainable, is to be preferred to three. The roots of Roses naturally run deep; they may be termed borers, not spreaders, to invent two root-phrases that will hardly be found in any treatise, though their equivalents, tap and fibrous roots, will. There are also not a few advantages in running deep. If they do not find gold, as the deep plougher is said in the song to do, they find those inorganic constituents of the soil, such as the oxides of iron, and other mineral matters, which are thought to impart more solidity of substance, and yet brighter colouring, to Roses. Besides, the deep roots are holdfasts in storms, and enable Roses to hold out long against severe spells of drought, the latter being amongst the most destructively injurious trials to which they are subject. Finally, the depth adds vastly to the area of the Rose larders, being in fact our only practicable method of doubling or trebling its extent and contents, without any addition to either its length or breadth. Hence, the deeper the beds or borders for Roses, the longer they may be expected to thrive in it without renewal or addition.

Drainage.—The richer, better, deeper the Rose soil, the more urgent and pressing the necessity that no stagnant water shall lodge in or immediately under it. Water in excess at the roots has slain its tens of thousands of Roses, as against the thousands killed by atmospheric severities and sudden changes.

Stagnant water breaks down and utterly destroys the texture, and that is very much the air-holding capacity of soils. Most of the admixtures recommended here have been for the main purpose of improving texture. The presence of stagnant water for only a short time renders most of all this labour lost, and will convert the best and most skilfully compounded soils into something very nearly allied to a muddy pond or stagnant ditch.

The remedy is simple as it is obvious. All naturally rich ground should be thoroughly drained at least a foot below the level of the soil provided for the Rose-roots. Should this be three feet, the drains should be four at least, and so in proportion for deep or fleet root-runs. As to the distance of drains, that will be determined very much by the retentiveness of the soil, the amount of fall, the materials used, &c. From ten to twenty feet will generally prove efficient distances on Rose soils. (See chapters on DRAINAGE.)

Plans.—Roses are so sweet and charming that they must be largely used in forming and enriching flower gardens, and also for forming and furnishing gardens devoted entirely to themselves. In planning Rose gardens, the chief points to bear in mind are to choose simple figures, and avoid angles as far as may be, as Roses can hardly be trained so as to furnish sharp corners or angles.

Fig. 25 is a group of figures that look remarkably well on a rising bank, the lowest part being at the semi-circle in the middle. It also looks well on level ground, with a gravel walk led across near the semi-circle. Where room is plentiful, the other half could be added, thus converting the group of Rose beds into a Rose garden, surrounded, if need be, say nine or twelve feet from the circle, with a tall Rose hedge from six to ten feet in height. But, as it is, Fig. 25 could be planted thus: No. 1 could be cleared away for a seat, or expanded into a Rose arbour or temple, or planted with any pale-coloured or white Rose, such as Boule de Neige. No. 5 should then be planted with Duke of Edinburgh. No. 4, Celine Forestier. No. 6, Triomphe des Rennes. No. 3, Marie Bauman. No. 7, Alfred Colomb. No. 2, La France. No. 8, Lady Mary Fitzwilliam. The circular beds could be furnished with dwarf standards, three or five in a bed, or with strong-growing dwarfs. No. 9, Gloire de Dijon. No. 10, Charles Lefebvre. No. 11, Baroness Roth-

schild. No. 12, Madame Thérèse Levet. No. 13, White Baroness. No. 14, Safrano, or Belle Lyonnaise. But these are mere samples of many other methods of furnishing that might be adopted, or the beds might be furnished with mixed dwarf and standard Roses in the usual way. The circles could also be filled with large standard or weeping Roses, only one plant in each.

Fig. 26 looks well on a long narrowish piece of turf, such as may often be met with in gardens, and may be furnished in the usual mixed style, either with standard or dwarf Roses. If looked down upon from a higher terrace or window, it would, however, look best furnished with dwarf Roses, each bed of one sort. No. 1 could be filled with Souvenir de la Malmaison, one of the best

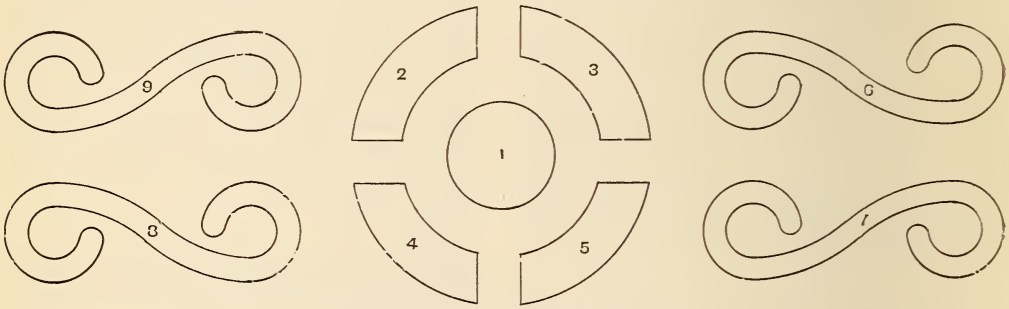


Fig. 26.—Plan for Beds of Roses on Turf.

of all Roses for forming continuous floriferous groups. No. 2, Charles Lefebvre. No. 3, Marie Bauman. No. 4, Marie Rady. No. 5, Duke of Edinburgh. No. 6, Marie van Houtte. No. 7, Gloire de Dijon. No. 8, La France. No. 9, Marshal Niel, or Madame Trifle; or the four S-shaped beds could each be divided into three, the centre furnished with one sort, and the two corners each with a different and distinct variety, thus converting each for furnishing purposes into three beds. In that case the centre might be furnished with some of the more brilliant-coloured perpetuals, such as Duke of Edinburgh, Madame Victor Verdier, Maurice Bernardin, Senateur Vaisse: and the ends with such Teas and Noisettes as Madame Levet, Cheshunt Hybrid, Madame Maurin, Niphetos, Celine Forestier, Lamarque, President, Souvenir d'un Ami, &c.

Fig. 27 is a sketch of the largest rosary at Hardwicke, designed and furnished by the writer some twenty years ago. It is chiefly furnished with a mixed collection of standard Roses of different heights, each of the larger beds containing over a hundred plants a-piece. The curved beds at the end have a narrow edging of Persian Yellow and Copper Roses. The whole is about forty-five yards long and about twenty wide. The turf paths between the beds are three yards wide, and the line of outer circles are six yards from the beds, and carried round one end of the rosary. These are furnished with a single large standard Rose each—a white and a pink alternating, the sorts used being Madame Plantier and Charles Lawson. The form and style of the beds are well adapted for Roses, and when the plants escape the spring frosts, few sights are more rich and satisfying than this large garden full of Roses of all sorts and shades of colour.

The Actual Planting.—Having thoroughly prepared the root-runs, and if possible left the soil with a surface as rough as possible, to be ameliorated and sweetened by sun and air, wind and rain, frost and snow, and the whole mass to be partially consolidated by time, the preparations for planting should be proceeded with and completed. Questions of distance, stakes, &c., should also be determined in advance. The old practice of making the holes several months before planting is also of great use, though now generally set aside in these times of express trains and telegrams and telephones. By some of these means our Roses are ordered in the morning, and sometimes delivered and planted in the afternoon. This is no doubt almost heroic in its suddenness; but, in the end, not seldom illustrates the truth of the old axiom, "The more haste the less speed;" not that the speed itself is dangerous provided the work is well done and due preparation made for it. The mellowing and pulverising of the sides and bottom of the holes for Roses by exposure, was a cheap and easy way of starting the roots in soil of the very best and most root-tempting quality.

To make the whole art of planting Roses more plain, it may be best to treat of it under the following distinct sub-headings: Distance, Depth, Disposition

and Covering of the Roots, Solidity, Stability, Mulching, and Arrangement of the Plants.

Distance.—The distance may range from two feet to thirty, according to soil, site and situation. The first is a fair distance for dwarfs, or very low standards in line, or mass in beds or borders; the latter not excessive for fine finished standards, furnishing the sides of a ten or fifteen feet walk. Pyramidal or Pillar Roses need almost equally great distances to render them effective, whereas Weeping Roses look best so far asunder as to be seen all round without compression or contact with other plants or forms. But all these may be treated here as exceptional, and the general principle determining distances apart in reference to effect may be determined chiefly by their breadth and height, and the purposes and positions for and in which they are planted. The majority of rose plants come under the general designation of standards and dwarfs. For the first the range of distance may reach from two feet to four, three feet being a good average. For tall and strong-growing standards, however, five will not be excessive, and two or two-and-a-half feet will be found ample for the dwarfer and weaker standards.

For Dwarf Roses the distance may range from one foot to three; from eighteen inches to two-and-a-half feet being the more usual distance.

Roses on walls may average a yard apart. Many, such as Marshal Niel, and Gloire de Dijon, would speedily cover ten times the area thus allowed them. But as the stronger growers spread far and wide, the weaker and less valuable ones may be cleared away; and as rose plants are cheap, and roses and wall space valuable, thick planting pays best. Besides, not a few of our finest Tea Roses grow rather slowly, and planted a yard apart on a six feet wall, it will be several years before they cover it.

Climbing and Trailing Roses are generally planted at distances of from five to twenty or more feet apart, as some of these will run so many feet in a single season.

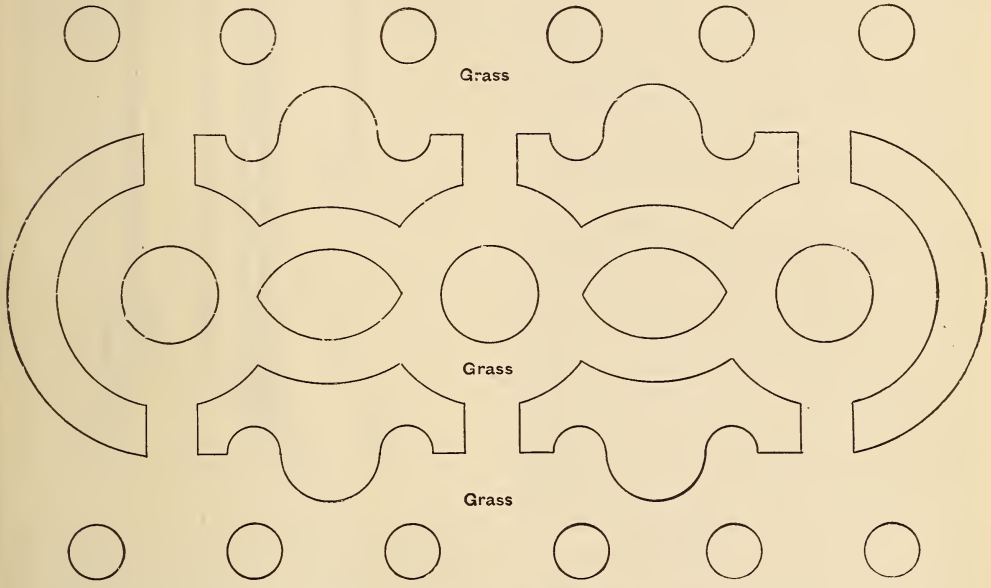


Fig. 27.—Rose Garden at Hardwicke.

Depth.—Most Roses are planted too deeply. This is often done thoughtlessly, more frequently in the hope of saving the labour and cost of staking and tying. It is very injurious, and proves in fact one of the most fruitful sources of disease and death. Besides, the roots of roses mostly run rather too deeply, plant them as we may, and it is not worth while to intensify this tendency by starting them too low in the soil at planting. Deep planting also makes the roots to multiply suckers, a provoking tendency, sure to be sufficiently developed without the planter's help. If the surface roots have a covering of three inches, and the lower ones of eight at the most, it will be found amply sufficient. Thus the root-plane of Roses should be found at starting

in the space of five inches, beginning at three under the surface. There is yet another reason for the shallow planting of Roses, and that is found in the fact that the roots hardly ever rise afterwards. Down, down, yet lower and lower down, runs their motto and their work through life. Hence the surface soil becomes more of a mere coverer, and less and less of a feeder, and consequently the roses should be planted fleetly, and the best food for them should proceed from the upper layer of roots to the bottom of their feeding quarters.

Disposition and Covering of the Roots.—Naturally the roots of Roses are more like underground sparsely-branched stems, than the fibrous bundles of recticulated tissue, each terminating in an open mouth, that we instinctively associate with the name and character of roots. Perhaps nothing disappoints the novice in Rose-growing more than his first practical acquaintance with their roots. It even tempers the enthusiasm so admirably expressed by my friend Canon Holte—Canon and Bishop among our Roses, in his charming book about Roses, "How it cheers the Rosarian's heart amid those dreary days (November), to welcome that package from the nurseries, long and heavy, so cleanly swathed in the new Russian mat, so closely secured with the clean white cord. His eyes glisten, like the schoolboy's when the hamper comes from home; and hardly, though he has read the story of 'waste not want not,' can he keep his knife from the string." But his pang of disappointment is great as he turns from the tops of fishing-rod length and suppleness to the roots, which are too often like a whipcord, broken off short in the middle. In almost every instance their size, form, and number, are grievously disappointing.

But as every minute's exposure to the air is dangerous, the sooner the roots are dressed and disposed of under ground the better. The dressing consists in cutting off all wounded and bruised portions with a sharp knife, and at as an acute an angle as is possible. This done, and assuming that the holes are ready made, fill in to within three or five inches of the surface, levelling the bottom and treading it quite firmly. If not made before, or the bed or border thoroughly prepared, the holes may be dug out to a depth of eighteen inches or two feet, and of a similar or greater breadth, and then filled in with a mixture of turfy loam and manure, or such as that already recommended. Fill in, tread in, and for standards drive a firm stake into the centre of the hole before planting. All this, however, should be done before uncovering or dressing the roots, as the air if it is frosty proves most injurious. Then place the plant against the stake, and give it a single loose tie. Then proceed to give a horizontal direction to the root or roots, and if there are several let them be equally distributed over the area of the hole; cover these with some of the finest and best soil; and if this is not good enough a few spadefuls of a lighter soil into which a liberal addition of leaf mould has been added, is one of the best coverings for the roots of Roses. Fill in with the soil until the root-run is rather above the level of the ground, and the actual planting is finished.

By placing the stake first one person may plant Roses well; but, as a rule, time is saved by two being

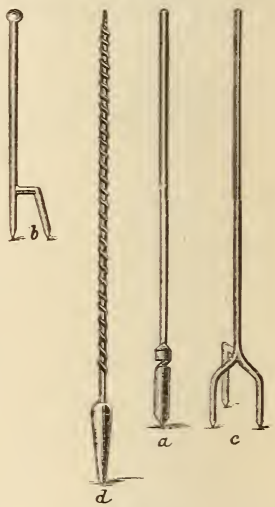


Fig. 28.—Iron Stakes.

engaged in the process. And this is one of those operations which cannot be done too rapidly.

Solidity.—This must be attended to before and in the planting as well as afterwards. The base of the hole, if the soil is in good condition, can hardly be made too solid before planting. Then sprinkle it over with good soil or compost, place the roots on this, cover over and tread down carefully, when quite filled in tread again. Rose-roots and briars are accustomed to have a solid root-run, and a certain firmness of the soil under and over the roots seems necessary to enable them to bite or run freely into it.

Stability.—This is as essential to success as solidity. These are, in fact, correlated throughout. Deep and hard planting were both adopted to give to roses and other plants solidity, as it was found that they could not possibly root while their tops were endowed with the power of levers to snap the fresh fibres by every passing breeze. Prompt staking the moment they are planted, or even before, is, however, by far the best method for rendering the tops and roots alike immovable. In the first tying

of newly-planted Roses, the string should be first tied firmly round the stake, and sufficient room left to tie round the stem to enable it to slip down with it as it subsides with the earth. If both are tied together in the usual way, the stake having reached to the solid earth under, the compost will not sink with the Rose, and the latter will be suspended to the stake to the straining and breaking of its roots.

The fragility of wooden stakes is, nevertheless, a great drawback to the stability of Roses. When in full beauty of leaf and flower, and consequently affording most purchase for the wind, the stake snaps, and too often the stem of the Rose-tree with it—and all is wrecked in a moment. To avoid

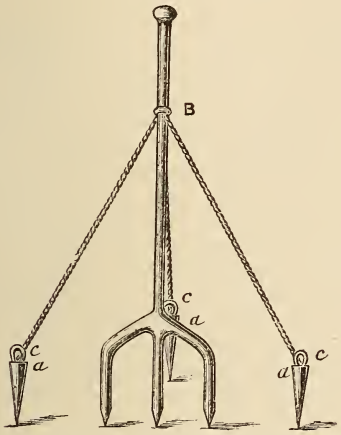


Fig. 29.—Stake with Stays.

such risks, iron stakes, like those shown in Fig. 28, are largely employed in many gardens in lieu of wooden stakes. In Fig. 28, *a* is a very simple and useful stake, the peculiar narrowing twist a few inches from its base adding much to its stability. Another capital stake of similar character, with a small knob at top and a prong or fork at bottom, is shown in *b*. *c* is a plain iron stake, with three prongs, set in a triangle that renders it immovable under any ordinary pressure. The stake lettered *d* is, however, the most ornamental and the best. The mass and weight of its base, as well as triangular or square form—for they may be made of either shape—give it a firm grip of the earth, while the endless-screw appearance is not only highly ornamental, but adds to the practical usefulness of the stake by providing a complete antidote to tie-slipping. The chief drawback to this stake arises from one of its merits. The considerable mass of iron so near to the root-stock often causes a sort of rust among the roots, that proves injurious to them. The simplest antidote to the rust is an annual or biennial cleaning of the stakes, and the dipping of the earth portion in boiling pitch.

In Fig. 29 a stronger rose-stake is introduced. This is an enlarged edition of *c*, Fig. 28, with the important addition of three detached holdfasts, *a a*, connected to the centre stake by wire, yarn, or chain, *c*, fastened to a knob or ring in the stake at B. Properly secured, this stake is for all practical purposes immovable, and the largest rose may be tied to or trained up such with a perfect sense of security.

Mulching the Surface of the Roots.—Finally, after planting and making all firm and stable, cover the surface with four inches of litter, to make all frost-proof during the first winter, and to conserve the moisture in summer. This is the more needful as the roots will be nearer to the surface than usual, and will also be found to be abnormally active, and therefore unusually sensitive to extremes of heat, or cold, or drought.

Arrangement of the Plants.—This is more determined by taste than by any necessary rules of planting. For, however plants may be placed in relation to each other, the mode of planting should be the same. Still, much of the final effect of planting turns on matters of arrangement. For example, in forming a group of Roses, one would almost naturally place the tallest plants in the centre, dropping a foot or eighteen inches in each row, and finishing with dwarfs to meet the lowest standards on one side, and stoop to kiss the turf on the other. The effect would be far more pleasing than if the plants had been placed higgledy-piggledy without any special regard to height or distance.

Many of the charms of a bank of Roses may also be obtained on level ground by the simple expedient of selecting tall standard or pillar roses, for the back row. By having these say seven feet high, the next say five, the next three and a-half, the next two and a-half, the next eighteen inches, and the last Dwarf or Fairy Roses, will be formed a broad rising bank of the most telling character. Again, by planting standards rather thinly, dwarfs may be planted between them, and thus cover the ground, and make the bed or garden of roses still more bright and beautiful, with a perfect prodigality of buds and blossom. Pillar, Pyramidal, or Creeping Roses might also be chosen for centres of groups, skilfully distributed among Dwarf Roses, or so disposed as to rise up naturally, into a hedge or a bank of roses.

But these hints only suggest rather than exhaust the infinity of arrangements and combinations with themselves and other plants, such as Honeysuckle, Clematis, &c., that may be thought out and carried into effect by the skilful planter of roses.

SUBURBAN GARDENING.

By James Hudson.

THE GREENHOUSE AND CONSERVATORY.

THIS addition to small suburban and villa gardens can be made very enjoyable, and thus afford the means of recreation and amusement when the weather is unpropitious for out-of-door occupations. It often happens, however, that the structure is erected in some out-of-the-way corner of the garden, with an unsuitable aspect, or overshadowed with trees; or else, when attached to the house itself, it is so arranged as to be of little use for successful plant culture, either by reason of its indifferent construction to attain these ends, or by the position in which it has been erected. No thought in the latter case is often exercised in respect to the beneficial influence of the sun's rays upon indoor plant life.

Position. — As regards the aspect in which a house for plant growth is to be erected, it is necessary to say that south, south-west, or west are in every respect far better than any other point of the compass. East or south-east would possibly be more exposed to cold piercing winds, as well as catching the early sun in the morning, before, in some cases perhaps, any attention could be conveniently given to ventilation or the more immediate requirements of the plants themselves. Should the temperature have declined too low, the first-named aspects would be much better during the winter months. Then the plants would not be so likely to suffer by exposure to the sun's rays after having been in dangerous proximity to the freezing-point. We therefore advise both the northerly and easterly aspects to be avoided in every possible case.

In the event of span-roofed houses being chosen in preference to the lean-to, we would still prefer the same aspect in all small erections, but we do not advise this class of house to be erected in such gardens. They are more liable to sudden variations in temperature than the lean-to; especially is this the case in small erections. The lean-to has the advantage of shelter, and will in most cases be found to maintain a higher temperature, and withstand the inroad of frost without so much artificial heating.

Small houses for the culture of plants are also frequently built too high, causing the plants to become unduly drawn up or attenuated in their growth. Height oftentimes has to do duty for more superficial space, and shelves for the plants, tier above tier, are arranged as a compensation thereto. These positions, however, are not desirable places for the successful growth of plants, the drip from one row of plants falling on to those beneath them. In order to remedy this as much as possible, the shelves should graduate in width; each of them should also be fixed a short distance away from the wall when arranged for in such a position, keeping the narrowest one as a matter of course at the top. This would be a very good plan to follow when any wall-space has to be covered, but a better way still would be to plant climbing plants to attain these ends, with one fairly wide shelf only within easy access for the use of the water-pot. The endeavour throughout should be to secure the maximum of light for the growth and healthy development of the plants, and yet contrive to cultivate as great a variety as possible.

Shade.—We strongly advise climbing plants also for the roof, and if one is named in preference to any other it is *Passiflora cærulea*, the Blue Passion Flower. It is one of the easiest plants to manage, and would afford an excellent means of shading for the roof during the summer months. Care must, however, be taken to keep the shoots from becoming entangled with each other to any extent, thus causing a dense shade to be imparted to the plants beneath it. As the autumn advances the shoots should be carefully thinned out to let in more light, and those that are left can be tied into bunches of three or four each, and opened out equally over the roof again in the spring, when signs of active growth are apparent. Several other climbing plants could be used with every hope of successful culture. *Lapageria rosea* and *L. alba*; *Tacsonia Van Volxemii*, a species of Passion Flower; *Solanum jasminoides*; *Habrothamnus elegans* and *Cobœa scandens*, with its variegated-leaved form, would either of them prove well worthy of cultivation. The two last-named genera would be of somewhat robust growth, and therefore excellent subjects to cover a wall of more than usual dimensions. The natural means thus advised to be employed as a means of shading the roof would be far preferable to either a blind to roll up and down the roof, or that disagreeable and unsightly method of besmearing the glass with whitening to attain the desired end. Unless any objectionable outlook on either side has to be studied, clear glass is far preferable to employing any kind that would obstruct the light. If any medium to break the view is needed, we would prefer glass of a pale green tint in lieu of either ground or rolled plate glass.

The floor of the interior of the structure should be so arranged as to allow sufficient space for soil wherein to plant the climbing plants. The remainder of the surface might be advantageously paved, according to taste, and thus be easier kept sweet and clean. If the house is elevated above the

ground-line, paving throughout had better be resorted to, and the climbers be planted in slate tubs.

Heat.—The artificial heating of the structure itself, as previously hinted at in a foregoing chapter, might with ease be effected by connection with the kitchen boiler, when that article of daily use is of sufficient power; if otherwise, a small gas boiler *outside* of the building would answer the purpose. Three-inch hot-water pipes would be sufficiently large for all purposes in a small building, provided the quantity used is liberal in proportion to the size of the house. These should be arranged against the *exterior* walls, if possible, not carried along the back wall, as is oftentimes done in small structures. In the former manner the heated air will be better disseminated into the surrounding atmosphere, and likewise keep out more cold frosty air from the most exposed positions. A *self-registering* thermometer is strongly advised, as affording reliable *data* to work upon in regulating the heating power during the night. For this purpose a *minimum* instrument, *i.e.*, one that records the lowest temperature, is the one to use; whilst for recording the highest range of the glass during the day, a *maximum* would be the one to select. We advise both to be used, but more especially the former. They are made in combination, but the proper working of this kind is very liable to get out of order and mislead even those who are well experienced in such matters. These thermometers should be prevented from being unduly run up, and thus recording a higher temperature than is really existing. This is caused by the sun shining direct on to the tube containing the mercury or spirit, as the case may be. To prevent the occurrence of this, a thin casing of wood to screen the instrument from the direct action of the sun would be effectual.

Ventilation.—It is necessary to remark that some discretion is required in the management of this, one of the most particular points of detail in successful culture. During cold weather, with a prevalence of either north or easterly winds, but little ventilation will be required, and the air then admitted should be given in such a way as to avoid the possible injury that might accrue during this state of the weather. Do not admit any air where the full force of the wind will be likely to enter the house and exhaust the vitality of the plants by the sudden lowering of the temperature. During warm summer weather, a little air should be left on all night, and arranged so that a free circulation is secured. The plants will thus recoup themselves, and their vitality will be strengthened against the possible strain they may have to endure through a period of hot weather. During both spring and autumn, when there is no danger apprehended of any morning frost, a little *chink* of air will be beneficial to the occupants of the house at night.

The ventilation should be arranged for at the top of the house, by means of flap-lights to lift up, or, in case of a span-roof structure, by lights that are hung on a pivot in a lantern roof. This latter, however, is a more expensive mode of procedure, whilst the former can be adapted to either style. Sliding lights are not to be recommended at all, although they are much used. During rainy weather more attention is needed in drawing them up, and the working gear is more liable to get deranged. The arrangement for the admission of air in the front should be by lights hung on hinges to the lower side of the plate that carries the roof. A few air-bricks also will allow for a considerable amount of air to pass into the house, and, when possible, these should be fixed on a level with the hot-water pipes. The staging on which to stand the plants should be arranged to suit taste and convenience, provided it is not at an inordinate distance from the glass.

In the event of no greenhouse having been built, and provided the possession is by lease or yearly tenancy, what is termed a "tenant's fixture" would afford an excellent substitute for a more permanent structure, with bricks and mortar for the foundation. The "tenant's fixture" is entirely composed of wood and glass, resting on a solid bottom, and thus removable at pleasure. This kind of house is frequently seen advertised, and the price at which they are produced is astonishingly low for the work there is in them. There would be in such a house an abundant source of pleasure, to be derived in the cultivation of at least a few plants of comparatively easy growth. One precaution, however, would need to be taken when dealing with this kind of building, and that is, to look well after the painting of the lower portions that are within close proximity to the ground; else decay will in all probability soon set in, all the sooner if in contact with the ground itself.

Vine Culture.—We have previously reverted to the cultivation of climbing plants as affording a means of shading, and in our last article we also hinted at vine culture. Should the latter be chosen, the climbing plants would not be required. If any one can devote a fair amount of time—not necessarily to any great extent—we would certainly advise vine culture to be attempted. We do not by this mean to go to any considerable expense with all the accessories of first-class culture, but to endeavour to produce a few grapes in as simple a manner as possible, and with the least possible expense too. It is astonishing how well vines do thrive at times

when no preparation scarcely has been made for their culture. The greatest evil is that of over-cropping, and even what might be thought only a good average crop should not be allowed till the vines are thoroughly established. The vine is of such a fruitful nature that it would soon exhaust itself were not the crop greatly reduced, and the bunches themselves considerably thinned of a good number of their berries, when fine-looking grapes are desired. For an amateur in vine-growing, we would advise only the Black Hambro' and the Sweet-water (common) to be planted. These are two of the best sorts that could be chosen for such a house. Both of these kinds can be grown in a cool house, and ripened *without any fire-heat*, although a trifle of heat in the pipes would be beneficial during damp cloudy weather, and thus be the means of dispelling any excessive amount of atmospheric moisture. In a cold house, without any artificial heat, the greatest evil to be apprehended is an attack of mildew, which if not checked at once, will soon disfigure the entire crop. To avoid this drawback the house should be kept as dry as possible during dull, damp weather, and if any symptoms of this fungoid growth are seen, either paint the pipes with sulphur or dust a little very slightly into each bunch. In the event of the former remedy being used, the pipes should be fairly warm at the time of application, and then with the house closed the fumes of the sulphur will be readily discernible, and the mildew forthwith killed. Minute details of culture are not required from us, as the reader will obtain this practical information from the exhaustive articles by Mr. Coleman.

Plants.—The culture of all the best suited plants to make the house gay, at least for a few months of the year, will also be found under their respective headings. If we named any one genus in particular it would be that of the Pelargonium or Geranium—more particularly the greatly improved types of single and double Geraniums belonging to the scarlet or zonale class. The beautiful shades of colour in many of the newer kinds, both single and double varieties, cause them to be very attractive. Being also of easy culture, they should be much grown. A few plants also of the scented leaf varieties would no doubt be appreciated. The Geranium will bear being dry at the root better than many kinds of plants, and occasionally no doubt an omission in the watering might occur. On the other hand, be careful to avoid over-watering. This is a great mistake, very common in small gardens, and one from which the plants do not in many cases so quickly recover as in the case of the other extreme. Chrysanthemums should be grown, not only for the sake of making a display during the last months of the year, but for the choice and varied character of their flowers. Fuchsias, again, should have consideration, being of the easiest culture. Several species of Cactus would prove very interesting, not requiring such close attention as many plants. *Nerium Oleander*, a well-known old plant, is also of easy culture. Of bulbous plants that are kept on from year to year, there are the Agapanthus, the Vallota, the Liliums, the Calla or Richardia—all of these are valuable in their season; whilst for the spring months the Hyacinths, the Tulips, the Narcissus, with the Crocus and other bulbs in pots, would make the house gay for weeks. *Astilbe japonica* (also called *Spiræa japonica*), now so much grown for its feathery plumes, should not be omitted. The imported plants generally flower the best. Besides the Cactus already named, there are many succulent plants that are extremely interesting and curious in a collection, even in a small way.

Of plants grown for the beauty of their foliage, there are the hardier types of Palms, many kinds of tolerably hardy Ferns, *Ficus elastica*, or the Indian-rubber plant, and the Aspidistra, the last-named being very hardy. In conclusion, be careful not to accumulate more plants than can be grown without injury to each other by reason of overcrowding, as in that case not only will the plants suffer, but the general effect will not be so good.

It may perhaps be thought that we should have included Azaleas, Camellias, and some few other hard-wooded plants in the enumerations just given; but some considerable amount of practice and experience is required before such plants are grown with success. By the time any one becomes well grounded in such matters, other portions of this work will abundantly afford the information essential to their successful culture, combined with the practice already attained in dealing with the plants first recommended. Again, we may be thought to have overlooked the Chinese Primula, the Cineraria, and the Cyclamen; but these, with some few other kinds of flowering plants, can now be purchased so cheaply, and in far better condition than they can be grown among the other plants, that we advise their *purchase*; this, however, just before they come into bloom, and *not* as they are seen when offered for sale by the market growers, when they are in their best condition of bloom, and cannot reasonably be expected to last so long as in the other case.

Pots and Potting.—Such purchases will not be altogether lost afterwards, for the pots and even the soil can be used again for the general stock. We do not, however, advise the latter plan to be

followed unless fresh soil is not readily obtainable; but the pots are always available, not omitting that most necessary item of cleanliness, well scrubbing the outside and inside of each pot before being again used. Always preserve sufficient of the broken pots to act as drainage to the plants when being repotted, but see that these even are well cleansed before use. After plants have been fresh potted be cautious in the use of the water-pot for some little time, until signs are seen in the growth of the plant that it is assimilating to itself the properties contained in the new soil.

SUITABLE SUBJECTS.

As a guide for those who are selecting material wherewith to furnish their gardens, we purpose now to give a selection of some of the best, hardiest, and most suitable subjects to be employed.

Shrubs and Trees.—Of *evergreen shrubs* that are valuable for their foliage alone, or combined with the ornamental character of their flowers or *fruit*, there are several genera from which to choose. Some that we quote may be well-known kinds, but in order to make the list more complete it is necessary to mention them. *Arbutus Unedo*, the Strawberry tree, in some few varieties, requires a rather sheltered position to attain to a fruit-bearing state. *Aucuba japonica maculata*, the well-known old variety; *A. japonica vera nana*, the green form of the same, and both female varieties; *A. japonica maculata mascula*, the male form of the old kind; and *A. japonica viridis*—both of these should be grown, but one plant of each would be sufficient in a small garden in order to fertilise the female varieties. *Azara microphylla*, somewhat like the old *Cotoneaster microphylla*, but both are well worth growing as a foreground to other shrubs. *Berberis Darwinii*, beautiful when in flower; *B. Aquifolium*, also called *Mahonia Aquifolium*, one of the best shrubs for a small garden, the bronzy points of the young growths and leaves being very useful in floral arrangements; *B. stenophylla*, free-flowering. *Buxus sempervirens*, or the Box, is well known, both the variegated and green forms being useful, whilst the dwarf kind, especially the variegated form, is a very pretty shrub. *Cerasus Laurocerasus*, or the Common Laurel, needs no description, but the Colchic or *C. L. colchica* should be chosen; the Portugal Laurel, *Cerasus lusitanica*, is, however, the best in a small garden, and the myrtle-leaved kind of this, *C. lusitanica myrtifolia*, is even better still. *Daphne Laureola*, the Spurge Laurel, and *D. Cneorum*, the Garland Flower, are capital additions to the list. *Euonymus japonicus* in several varieties, but the green-leaved and oldest variety is still one of the most reliable. As to Hollies, there are several useful kinds of this valuable shrub. The common Green or *Ilex Aquifolium* is one of the most serviceable; another kind with larger leaves is *Ilex Hodginsii*, also very good; the variegated kinds are more to be recommended, not presenting such a sombre appearance; of these *Ilex Aquifolium* "Golden Queen" and "Silver Queen" are two of the best to select. *Laurus nobilis*, or the Sweet Bay, ought to be included if only for the sake of the perfume of its leaves. *Ligustrum japonicum* and *L. coriaceum*, the latter of dense habit, are two of the best kinds of evergreen Privet. *Ruscus aculeatus*, or Butcher's Broom, is useful for planting in the worst of positions. *Spartium junceum* and *Cytisus albus*, the yellow and white Spanish Brooms, are fast-growing and free-flowering shrubs. *Veronica Andersonii* and other species are well suited for the seaside, and in conjunction with the *Euonymus* should be freely planted.

Of the plants classified as "American," the Rhododendron is in the front rank, and needs no recommendation. Belonging to this section are also found the *Kalmia latifolia* and the *Pieris floribunda* (generally met with under the name of *Andromeda floribunda*), both being beautiful additions in the pure air of the country, but not satisfactory in either case when brought into the vicinity of fog and smoke. The hardy Azaleas may, however, be planted with prospects of satisfactory progress being made. The varieties of *Azalea pontica* are the hardiest, and therefore the most to be recommended; these will succeed where others fail. *Azalea mollis* and its varieties should not be chosen, being disposed to flower too early in the season.

Of deciduous trees and shrubs, *i.e.*, those that annually shed all their leaves, several kinds may be enumerated. The variegated Maple, *Negundo fraxinifolium*, or *Acer Negundo*, is a beautiful shrub, and presents a first-rate appearance as a standard. With a slight protection afforded them there are several recent introductions from Japan that are of a most beautiful foliation. Their leaves are much laciniated, and vary in the tints from pale green to a deep bronze purple; these species will without doubt become most popular. Of the Birch, one at least might be chosen if the grounds are of fair dimensions; one of the pendulous kinds would have a good appearance. *Catalpa syringæfolia* could be used instead of the Birch, its bold massive foliage and beautiful spikes of flowers being very effective; not suited for a very small garden. The double-blossom Cherry; the scarlet and pink, with the white variety of Hawthorn or May, are all most floriferous; the double kinds are preferable. The common Laburnum and a few improved varieties are all useful in their season. The Copper Beach should have a place, im-

parting quite a distinct appearance by the hue of its leaves.

Among the deciduous Magnolias there are some most showy flowers for the early spring. *M. conspicua* and *M. Soulangeana* are two free-flowering kinds, but require a sheltered spot. The Mock Orange or Syringa, otherwise *Philadelphus*, is well known for its fragrance when in bloom; *P. coronarius* and *P. grandiflorus* are two of the best to plant. The Siberian and Chinese varieties of the Crab, *Pyrus prunifolia* and *P. sinensis*, are most beautiful when in flower, and oftentimes well loaded with their fruits in the autumn. *Ribes sanguineum*, *R. aureum*, and *R. album*, three forms of the flowering Currant, are very distinct and handsome. The Locust Tree, *Robinia pseudo-acacia*, is most distinct and handsome in its foliage, with graceful spikes of flower during the summer months; the standards of this tree are preferable, and commonly called "Mop-headed" Acacias.

If either of the Willows are chosen, one of the small-leaved kinds of drooping or weeping habit would be the best, selecting a standard with a clean stout stem. Of the shrubby *Spiræas* there are a few kinds that are a valuable addition to a garden even of moderate dimensions; *Spiræa Lindleyana* and *S. ariæfolia* are two of the best. The Snowberry Tree, or *Symphoricarpus racemosus*, is useful in shaded or other indifferent positions. The common Lilac, or *Syringa vulgaris*, should not be overlooked in either of its colours. *Viburnum Opulus*, or Guelder Rose, is another most floriferous subject, lasting a long time in flower. Another good plant of bush habit is the Weigelia, of which there are several kinds, but *W. rosea* is one of the best.

Climbers.—Amongst the climbing plants, which we have previously laid considerable stress upon, there is an abundant choice. Of evergreen kinds, we can select them with bold and massive foliage, as in the case of the Magnolia, or with the minute leaves and graceful habit of the Cotoneaster. Some of the best are *Vitis striata*, frequently grown under the name of *Ampelopsis sempervirens*, the evergreen Virginian creeper; *Berberis Darwinii; Jasminum revolutum*, a yellow kind; *Azara microphylla;* Ceanothus in variety: *C. azureus* and *C. Veitchianus* are both good kinds; their pleasing spikes of flower and the freedom with which they grow when sheltered from the cold quarter, would soon cause them to be favourites; *Cotoneaster microphylla; Cratægus pyracantha*, which makes a splendid show in the autumn with its brilliant-coloured berries: *Escallonia macrantha* and *E. macrantha sanguinea* are splendid plants for covering a wall; their beautiful glossy foliage and compact trusses of bloom at once stamp them as first-class subjects; *Euonymus japonicus* in variety make an excellent covering medium for the wall of a house; *Garrya elliptica*, with its catkin-like appendages, in the early spring is most welcome and very distinct; strongly recommended. *Magnolia grandiflora*, "Exmouth" variety, is one of the most noble plants that we possess for planting against a high wall or building.

Myrtus communis and *M. augustifolia*, the common and the box-leaved Myrtles, will succeed in the south of England against a warm wall, and flower abundantly. *Punica Granatum flore-pleno*, or the Pomegranate, should have a warm corner, but neither this nor the Myrtles had better be tried near towns where the air is much contaminated.

Besides these that we have named, we have a whole host of Ivies, than which it is hardly possible to name anything better for planting in unfavourable positions and localities. The Irish Ivy (*Hedera canariensis*) and the English Ivy (*Hedera Helix*) are well-known kinds. Others with distinct foliage could with advantage be chosen, such as *Hedera dentata* and *H. Rœgneriana*, two kinds with fine massive foliage of a shining green colour. On the other extreme, in variety of their leaves, we have *H. H. digitata* and other kinds, with very small leaves. There are also the variegated-leaved varieties, with silvery and golden markings, several of which are most interesting and distinct.

Amongst the deciduous section of climbing plants there are several kinds that amply make amends for the loss of their leaves during a portion of the year, by the abundant display of bloom which they produce in their season. The foliage is hardly off *Jasminum nudiflorum* before its adventitious blossoms begin to make a gay display, unless a more than usually severe frost intervenes to destroy their beauty. As a contrast to this species, we have *Jasminum officinale*, that flowers a great portion of the summer. The Blue Passion Flower, *Passiflora cærulea*, already named in this article, should be included in the list of those for the open wall or verandah. There are also the large family of the Clematis, in various shades, from deep blue and purple down to almost pure white. *Clematis Jackmanii* is a well-known kind, of good constitution, and very free-flowering, with deep purple flowers. There are also many others that vary in their colours somewhat from *C. Jackmanii*, and of the same type and habit. *Clematis Flammula*, the Virgin's Bower; *C. vitalba*, the Traveller's Joy; and *C. montana*, are all worthy of a place, being well-tried kinds.

The well-known Virginian Creeper hardly need be mentioned, but another species, *Ampelopsis tricuspidata*, with smaller foliage and beautiful markings, is strongly recommended: it is the *Ampelopsis Veitchii*

of catalogues. It has the property of clinging most securely against the wall to which it has been trained. *Aristolochia Sipho*, with large and striking leaves and curiously-formed pipe-like flowers in the spring, is another desirable creeper. The Honeysuckles are well known for their fragrance, but besides these varieties there is the golden form from Japan, with its beautifully-veined leaves (*Lonicera aureo-reticulata*).

For a strong-growing climber with handsome flowers, there is nothing to surpass *Wistaria* (*Glycine*) *sinensis*. In a sheltered corner the delicious perfume of the flowers of *Chimonanthus fragrans* and its varieties would be extremely grateful in the early months of spring. Against a low wall, two forms of the *Hydrangea* are very useful, producing fine trusses of flowers; they are *H. hortensis*, "Thomas Hogg," and *H. paniculata grandiflora*. *Indigofera floribunda* should also prove a good climbing plant; its white pea-like flowers are freely produced, and its foliage is handsome as well. Suitable kinds of Climbing Roses will be found under their own special list. There are also several rapid-growing annuals that, for the season of their growth, will make a good display; the Nasturtiums, or Tropæolums, *Cobæa scandens*, and *Convolvulus major* are among the best of these.

Coniferæ.—Amongst those of the Fir-tree tribe and their near allies, there are some few species in the several genera which will be suitable in the suburban garden. Respecting Fir-trees in particular, the perusal of our previous article will give more immediate information. We there stated what were the best among the Firs, &c., and now only repeat their names, with a few additions thereto, viz., *Pinus austriaca*, *P. excelsa*, *P. Cembra*, *Tsuga canadensis* (the Hemlock Spruce), *Araucaria imbricata* (the Chili Pine), *Cedrus Deodara* (the Deodar). *Wellingtonia gigantea*, the Mammoth Tree of California, should not be planted in the smaller gardens, nor in any that are in close proximity to the smoke. Amongst the Arbor-vitæ class of the Conifers, *Biota orientalis aurea* (Golden Arbor-vitæ), *Cupressus Lawsoniana*, and its varied forms, are among the most handsome of any, and well suited for a small garden; *C. nutkaënsis* (*Thuiopsis borealis*) is another hardy and distinct kind; *Juniperus chinensis* (the Chinese Juniper) is also a useful plant of erect habit; *Retinospora obtusa*, and its varieties, *R. plumosa* and *R. filifera*, are all compact shrubs of neat and handsome growth; *Taxus baccata* (the common Yew), and its variegated forms, chiefly the golden kind and the Irish Yew (*Taxus baccata fastigiata*), are all most hardy and enduring trees. *Taxodium distichum* (the Deciduous Cypress) is a handsome, close-growing tree, and will thrive when fairly away from the smoke.

Roses.—The list of these that one sees published by the large firms in the country has need to be condensed somewhat largely for suburban gardens. There are a few well-known kinds, as Gloire de Dijon, Cheshunt Hybrid, Madame Berard, Devoniensis, and Madame Falcot (beautiful in the bud), from among the tea-scented class, that will in almost every case give satisfaction. Marshal Niel might be included, but although its flowers are gorgeous, yet in a suburban garden it can hardly be recommended by reason of its fickle character and aptitude to canker. Of the Hybrid Perpetual class, La France is one of the very best, if not the best of all; its lovely pink flowers are produced in constant succession the summer through; Alfred Colomb is a good bright red; A. K. Williams and Dr. Andry, both shades of red, have fine flowers; Duke of Edinburgh, very hardy habit and of most vivid colour, is one of the best of all the high-coloured varieties; John Hopper, with rosy-crimson flowers; Edouard Morren, a beautiful bright pink; Baroness Rothschild, pale delicate rose; Urich Brunner, rosy-lilac; François Michelon, deep rose; Marie Baumann, light crimson-red; and Boule de Neige, one of the best whites, are a good reliable dozen to start upon. Charles Lawson, a hybrid China, is good for walls; so also are all of the Teas at the head of this list; and the following also are excellent climbing varieties, viz., the Ayrshire, with the Banksian, the Boursault, and the Evergreen Roses, to which may be added Aimée Vibert, from among the Noisette: Celine Forestier, belonging to the same class, is also a beautiful pale yellow Rose, but should have a sheltered position. One or two of the best Moss Roses might be added, but as they flower but sparsely in the autumn, they can hardly be recommended.

Herbaceous Plants.—This is a numerous class, but we shall only mention a few of the best of each. Of tall growth, the Delphiniums (Larkspurs) are very showy; *Helianthus multiflorus*, both single and double kinds, are two fine types of the Sunflower, with medium-sized flowers; the herbaceous Phloxes (*P. decussata* and *P. suffruticosa*) afford a great variety; *Lathyrus latifolius* (the Everlasting Pea), in varieties, and *Spiræa Aruncus*. Of medium growth, the Aquilegias or Columbines; the Asters or Starworts; the taller of the Campanulas or Bell-flowers; the Chelones; the Linums or Flaxes; *Rudbeckia speciosa;* the Statices or Thrifts; *Anemone japonica*, or the Windflower; *Tradescantia virginica*, or the Spiderwort; and

the Veronicas or Speedwells, are all good selections. Of dwarf growth, and suitable for the front row, are the Alyssums or Madworts; the Arabis or Wall-cress; the Armeria or dwarf Thrifts; *Bellis perennis*, or the Daisies; the dwarf kinds of Campanulas; the Pink and Carnation; the *Helleborus niger* or Christmas Rose; the Iberis or Candytufts; *Myosotis azorica* and *M. palustris*, the summer-flowering Forget-me-nots, and *M. dissitiflora*, the spring variety, which require a moist corner; the Primroses and Polyanthus; the Saxifrages, among which is the London Pride, and the Violas or Pansies. These will all do good service.

Bulbous or **Liliaceous Plants.**—Of these several are well worthy a place in the smallest garden. The Lily of the Valley, which needs a damp spot; *Dielytra spectabilis*; the Funkias, having handsome foliage as well as flowers; the Iris or Fleur-de-Lis; the Liliums, a numerous class; the Narcissus or Daffodils; Solomon's Seal, handsome in growth; the Scillas or Squills, of which *S. sibirica* and *S. campanulata* are two of the best; *Tritoma uvaria*, the Red-hot Poker; the Hyacinths, Tulips, Crocuses, Snowdrops, and Gladiolus or Sword Lily, are some of the best of a valued family of plants.

Of plants suited for **Vases,** a few only need enumerating among hardy genera. The Creeping Jenny, or *Lysimachia nummularia*, is well known and one of the best; *Convolvulus mauritanieus*, perhaps a doubtful plant to choose as being hardy, otherwise a very pretty thing; *Campanula fragilis* and *C. garganiea; Glechoma* or *Nepeta hederacea* or Ground Ivy; the smaller-leaved and slender growing Ivies. The Tropæolums, the Ivy-leaved Geraniums, the single Petunias and dwarf Lobelias, are all good for the summer season only. As a central plant for vases, either *Yucca recurva* or *Y. gloriosa* is an excellent hardy plant; the Agaves furnish us with material of bold habit for the summer season, and the protection of a green-house during the winter months.

Annuals supply the suburban garden with a very useful section of plants. The list of these in the seedsmen's catalogues is of considerable length, but we will note only a few of the best. H.h.a. denotes half-hardy annuals; such require a slight protection in the earlier stages of growth: h.a. denotes those that are hardy or comparatively so. Asters, h.h.a.; Balsams, h.h.a.; Calliopsis, h.a.; Candytuft, h.a.; Collinsia, h.a.; Convolvulus, h.a.; *Centaurea Cyanus*, or Blue and other shades of Corn-flower, h.a.; Eschscholtzia, h.a.; Myosotis or Forget-me-nots, h.a.; Godetia, h.a.; Jacobœa or Senecio, h.a.; Love-lies-bleeding, or *Amaranthus caudatus*, h.a.; Lupinus, h.a.; Marigold, h.h.a.; Mignonette, h.a.; Nasturtium, h.a.; Nemophila, h.a.; Pansies (if sown early in the spring, flower as an annual); Sweet Peas, h.a.; Rhodanthe, h.h.a.; Scabious, h.a.; *Phlox Drummondii*, h.h.a.; Silene, h.a.; Stocks, except the Brompton, h.a.; Sunflower, h.a.; *Tagetes signata pumila*, h.a.; Portulaca (beautiful for dry, sunny spots), h.h.a. We have not in most cases given more than the generic name, but reference to a descriptive catalogue will furnish more fully the information required.

Of **Hardy Biennials** or **Perennials**—*i.e.*, plants that flower the year after being raised from seed—we have a few that should be included, viz., Antirrhinums, Sweet Williams, Wallflowers, Columbines (Aquilegias), Canterbury Bells (Campanulas), Carnations and Pinks, Primroses and Polyanthus. These are all easily-cultivated subjects.

Of **Rock Plants** we will enumerate a few of the hardiest only. The Sedums or Stonecrops; the Sempervivums or House-leeks; the Saxifrages, among which is the London Pride; the dwarf Campanulas, as *C. cæspitosa* and *C. muralis; Cerastium tomentosum; Veronica prostata; Vinca herbacea*, *V. major* and *V. minor; Gysophila muralis* and *G. prostata* (beautiful for working up into button-hole bouquets), and the dwarf Phloxes, as *P. reptans* and *P. subulata*, are all well-tried selections. Of stronger growth and more suitable in the background are the cut-leaved Bramble (*Rubus laciniatus*), the small-leaved Ivies, and numbers of the hardy Ferns from the following genera—*Asplenium*, *Blechnum*, *Lastrea*, *Osmunda*, *Polypodium*, *Polystichum*, and *Scolopendrium*.

Of **Fruits** we recommend only well-tried kinds. Among *Apples:* Keswick Codlin, Irish Peach, Worcester Pearmain, Cox's Orange Pippin, Cox's Pomona, Hawthornden (both Old and New), Ecklinville Seedling, Gravenstein, King of the Pippins, Wellington, Winter Queening, Waltham Abbey Seedling, Blenheim Orange (not for a very limited garden, being too robust), and Annie Elizabeth; the latter variety fine for keeping.

Cherries: May Duke, Florence, Bigarreau Napoleon, Black Tartarian, and Morello.

Apricots: Hemskirk and Moorpark.

Currants: Black Naples and Lee's Prolific Black are the best of the black kinds; Red Dutch and Raby Castle, of the red sorts; and White Dutch, of the white or yellow kinds.

Gooseberries: Pitmaston Greengage, green; Crown Bob and Red Warrington, reds; White Champagne and Early White, whites; Rumbullion and Yellow Champagne, yellows.

Royal Muscadine *Grape* for a verandah or warm wall.

Nectarines: Lord Napier, Humboldt, and Elruge.

Peaches: Alexander, Grosse Mignonne, Barrington, Sea Eagle, and Walburton Admirable.

Pears: Jargonelle, Williams's Bonchrétien, Beurrè d'Amanlis, Louis Bonne of Jersey, Marie Louise, Beurrè Hardy, Beurrè Superfin, Crassane, Thompson's, Winter Nelis, Knight's Monarch, Glout Morceau, and Josephine de Malines, all dessert kinds; and Catillac, as a stewing kind.

Plums: Greengage, Jefferson's, Kirke's, and Coe's Golden Drop for the dessert; Victoria, Early Orleans, Winesour, and Washington for the kitchen.

Raspberries: Carter's Prolific and Fastolf.

Rhubarb: Linnæus and Victoria.

Strawberries: Vicomtesse Hericart de Thury and Keen's Seedling of the earlies, President and Sir Joseph Paxton for mid-season, British Queen and Myatt's Eliza of the later sorts.

Vegetables. — *Asparagus:* Giant Battersea. *Broad Beans:* Beck's Dwarf Green Gem and Green Windsor. *French Beans:* Osborn's Forcing and Canadian Wonder. *Runner Beans:* Scarlet (Old) and Painted Lady. *Beet-root:* Dell's Crimson or Egyptian Turnip-rooted, the latter for early use. *Kale:* Dwarf Green Curled. *Broccoli:* Veitch's Self-protecting Autumn, Penzance White, Purple Sprouting, Leamington, and Model. *Brussels Sprouts:* Veitch's Paragon and the Albert Sprout. *Cabbage:* Ellam's Early, Little Pixie, and the Rosette colewort. *Savoy Cabbage:* Tom Thumb. *Carrots:* Early French Nantes and James's Intermediate. *Cauliflower:* Early London and Veitch's Autumn Giant. *Celery:* Major Clarke's Red, Sandringham Dwarf White. *Cress:* American or Land Cress and the Common Watercress, both coming freely from seed in a damp corner. *Cucumber:* Stockwood. *Endive:* Round-leaved Batavian. *Lettuce:* "All the Year Round" Cabbage, and Hicks' Hardy White and Brown Sugar-loaf among the Cos kinds. *Mustard and Cress.* *Onion:* Silver-skinned and the "Queen." *Parsley:* Extra-curled. *Peas:* American Wonder, Little Gem, and William I. of the earlier; Criterion, Stratagem, and Veitch's Perfection for the main crop; and Ne-plus-ultra, with Omega, its dwarf variety, for the late crops. *Radishes:* French Breakfast, Red and White Turnip. *Spinach:* Prickly or Winter. *Tomato:* Orangefield Dwarf and Vick's Criterion. *Turnip:* Early Snowball, Veitch's Red Globe, and Chirk Castle (late). *Vegetable Marrow:* Moore's Cream. *Potatoes:* Ash-leaf Kidney (Veitch's) and Covent Garden Perfection, both being kinds with short tops, and very reliable in quality; the latter kind is a good succession to the former; if a later kind still is needed, Reading Russet is highly recommended.

The catalogues of respectable firms will furnish more complete information with reference to each list of suitable subjects that we have quoted.

FLORISTS' FLOWERS.

By Richard Dean.

The Cineraria.—It has been remarked in reference to this flower, with much truth, that "the comparative ease with which the Cineraria can be well grown, together with the exceeding beauty and variety of its flowers, will always ensure for it a high position in public favour." That it can be easily grown is shown by the fact that a gardener of our acquaintance, with limited glass accommodation at his command, adopts this rough and ready plan of raising seedlings:—He stands by themselves in a cold frame with an ash bottom, a few plants of his best varieties; here they shed their seeds, and presently the little seedlings come up in plenty. Still it is best, as a matter of precaution, to raise seedlings under glass, as an accident might cause the loss of the plants raised in the open air.

Time was when seedling Cinerarias of high-class quality were named, as varieties of Begonias and other plants are named now-a-days. These varieties were increased by means of cuttings taken from growths sent up from the roots at the end of the summer, put into small pots of light sandy soil, and rooted in a gentle bottom heat. In this way a favourite variety can be propagated, for no Cineraria can be depended upon to reproduce itself exactly from seed. The Cineraria has, however, become so improved of recent years that the naming of particular varieties is now seldom followed; and if it is done, only sparingly; for strains are so fine generally that seedlings are invariably found of high-class quality.

The Cineraria is a plant of rapid growth, very succulent, thirsty, requires generous feeding, and will not endure unharmed extremes of heat and cold. A cool treatment is necessary in almost all stages of its growth, but if frost seizes on the plants they are materially damaged.

The best time to sow seed is during the months of May and June; and, "as a rule, the plants raised in May will be found most valuable. The time when the plants will flower depends much on the manner in which they are grown on, whether rapidly or not; but, as a rule, a June sowing must not be expected to produce flowers until the following March or April. It is quite possible to have Cinerarias in bloom in November and December, and those who care for a display at that early period should sow in April." In sowing it is simply necessary to sow thinly in pans or pots of light sandy soil, and place them in a cool frame, or on a shelf on the shady side of a greenhouse. The seeds quickly germinate, and as soon as the plants show their second leaves, they should be potted singly into thumb pots—pots of

the smallest size — using a rather coarse soil, but taking care not to cover the hearts of the plants, which is an injurious practice. These plants need to be placed in a close frame; they should be shaded, and sprinkled overhead with soft water morning and evening until well established.

From the first the cultivator should aim to have his plants as robust as possible; and so when they have been kept close for a couple of weeks, the heat should be diminished and more air given. A temperature too high, or too much shading, will produce a weakly growth, which is fatal to the well-being of the plants. Nor must the plants be too much crowded, and so it is much better to grow a few specimens well than to have a larger number overcrowded, and in an unsatisfactory condition in consequence. A cold frame suits the plants, but it should be in a full exposure, but shading will be necessary from the sun: plenty of air must be given day and night when the weather is suitable, and the plants be frequently sprinkled over-head in warm drying weather. Immediately the pots are filled with roots another shift should be given. It is important that this operation be not delayed a day too long, as starvation at the roots soon shows itself by the leaves becoming of a pale green colour. It is a custom with some growers to shift from thumb-pots into the pots in which the plants are to flower, and this may be done with safety generally, though we have seen plants suffering from overpotting, but this because the soil appeared unsuitable, and the roots did not move freely in it. We have found that the best way to ensure good specimens is to shift from thumb-pots into four-and-a-half-inch pots, and then into eight or even ten-inch pots for the largest specimens. The last shift should be made by the end of October.

Some growers place their plants in the open air during August and September, giving them a position on a north border—under the shelter of a wall, or any building, is the most suitable spot; but a hedge should be avoided. There is, however, danger of the leaves being spoiled by hail or heavy rains. The grower should be watchful for any suckers that are thrown up from the roots. And when the plants are coming into flower, and there appears to be a superfluity of buds, a few of them may be removed with great advantage. The quality of the flowers and the brilliancy of their colours, will be greatly heightened by giving the plants a little manure-water twice or thrice a week.

It is well known that insect enemies prey upon the Cineraria. Mildew is more common at some seasons than others; and as a rule, it appears during July and August, especially after insufficient ventilation, in damp, dull weather, or where the plants have been left too long in one place, or too near each other. Weakness invites attacks of mildew also. On the first appearance of an affected leaf, the under-side and the soil should be dusted with sulphur, and no water should be given overhead until the malady has disappeared. Aphis is very apt to attack the Cineraria, and fumigation in the tobacco-smoke soon kills them. But the fumes of the tobacco should be applied only when the leaves of the plants are dry, and when the weather is still.

A few of the fine named varieties of Cinerarias can still be had, such as

Admiration.	Metis.
Bridesmaid.	Miranda.
Crimson Beauty.	Miss Burdett Coutts.
Eclipse.	Miss Eyles.
Great Eastern.	Purple King.
Lady T. Grosvenor.	Queen Victoria.
Lord Amberley.	Regina.
Lord Palmerston.	Snowflake.
Meteor.	Uncle Toby.

A few of these would form an excellent collection to take seed from.

Cockscombs.—The Cockscomb of the florist is *Celosia cristata*, and it is a native of Asia, and, as may be readily surmised, it derives its name from the peculiar inflorescence it produces—really an oddity in its way, but with a very imposing appearance. We have seen plants that were quite small in comparison with the inflorescence, the latter being of prodigious size, fifteen inches or more in length, and eight or nine inches in width. One looks on such an example in sheer surprise, and wonders how so small a plant could produce this huge mass of fleshy colour. Two things conduce to this end — first, a fine strain of seed; and secondly, high-class cultivation. The development of a fine head on a Cockscomb is a matter of good culture. The strain may be ever so good, but unless the plants are well grown, good heads cannot possibly result. Therefore, those who make a point of growing Cockscombs should start with a good strain, and they should not hesitate to pay a good price for what they would have in the shape of seed.

There are two sections of the Cockscomb, the tall and the dwarf, and the latter is the one mostly grown. There are several colours—orange, scarlet, crimson, and purple, the last two being the varieties most frequently seen. The best time to sow is in February, March, or April, according to the earliness or lateness of the season when the cultivator wishes to have his plants in flower. It is best to sow thinly in shallow pans of light rich soil, and place them in a newly-made sweet hot-bed, or on any gentle bottom heat, this being essential to the

successful germination of the seeds. As soon as the plants are large enough to handle they should be placed singly in very small pots, and shifted on into larger pots as required, so as to encourage growth without a check; and it is a good practice to keep the

The Cineraria.

plants in the hot-bed, or a fresh one, until the combs are formed. Many growers of Cockscombs spoil their plants at this stage by keeping them some distance from the glass in a brisk heat, where they become drawn, growing long and lanky, and really quite spoiled for decorative purposes. Some growers recommend that the young plants should be kept somewhat starved in respect of water, as it will have the effect of throwing them into flower. When the combs show themselves, the plants—selecting the best-formed combs—should be potted into good-sized pots, using a compost made up of rich sandy loam and good manure in equal parts. It is well not to exceed pots eight inches in diameter, and when the plants are pot-bound—that is, filled with roots—the combs soon develop themselves. The plants should be kept near the glass, but not allowing their tops to touch it, and they need to be treated to liberal supplies of water.

The routine of growing Cockscombs varies with the objects aimed at. Tall Cockscombs produce very fine

combs, but the dwarfer the plants are, the more are they valued when they are placed on the exhibition table. Growers have hit upon the following plan to shorten their plants:—When the combs are fully developed, the stems are cut through four inches or so below the comb, put into smaller pots of soil, and struck as cuttings in a brisk bottom heat. They soon take root, and the combs are not in the least injured. The result is large, symmetrical, richly-coloured inflorescence, on a dwarf stem, with healthy leaves close down to the soil.

Those who may hesitate to cut their plants through a few inches below the combs, may attain the same end, that of extreme dwarfness, by bending the plants down in the potting till the combs almost touch the ground. Subjected to a moist atmosphere and a high temperature, the stems emit roots which add greatly to the size and strength of the combs.

Red spider is apt to attack the Cockscomb, and if it makes headway the leaves become disfigured, turn rusty, and spoil the appearance of the specimen. A moist heat and requisite care will keep this pest at bay, and by keeping the plants near the glass they do not become drawn.

Any seeds they produce appear in the form of tiny scales on the sides of the combs near their base. The finer the quality of the strain the more sparingly, as a rule, do they produce seeds.

There is a section of tall-growing *Celosias* termed *C. pyramidalis*, that was introduced from Japanese gardens some years ago. They grow like upright shrubs, producing side branches as well as main shoots, which are surmounted by large feathery inflorescences partaking somewhat of the character of the Cockscomb. There are various colours—crimson, scarlet, purple, yellow, golden, &c. The culture of these is similar to that of the Cockscomb, excepting that it is not necessary either to starve or dwarf the plants. The freer the growth, the more stately plants do they make—splendid tall pyramid bushes, their handsome feathery inflorescences being most useful in the conservatory during the autumn season.

Cyclamen.—A genus belonging to the natural order of *Primulaceæ*, or Primroses. They are plants of great beauty and of very distinct characters. The root-stock is a *corm* (that is, the stem is reduced to a swollen bulb-like mass, but is entirely different from a bulb, which is made up of distinct layers of scales), and after flowering the leaves decay and die away, and the plants lie dormant for several months.

There are several species of Cyclamen natives of the southern parts of Europe, which are extremely handsome border plants. Pigs are scarcely ever credited with having a love of the beautiful in their composition, and yet they are extremely fond of Cyclamens. In Italy the plant is called "Pane Porcino," on account of the diligence which swine exhibit in the search after the roots, and in spite of their hot and bitter flavour they will devour them in great numbers. Italian pigs, it would seem, are not singular in their tastes, for their French relatives exhibit the same partiality for the roots of these beautiful plants, which in that country are known by the name of "Pain de Porceau," but in English they are called "Sow-bread."

It is as long ago as 1731 that the beautiful *C. Persicum* was introduced to this country from Cyprus. This is the type from which have been originated the charming varieties now so plentiful in autumn, winter, and early spring. We can quite imagine that for many years the new introduction was grown as an ordinary green-house plant, no one apparently caring much about it, and probably preference was given to the hardy types, such as *C. Europæum*, which is a native of Britain, and others introduced from abroad. *C. Europæum* grows also abundantly in the South of Europe, in elevated positions, and particularly in Sicily, where the swine eat the root-stalks with great relish, hence its common name, *Sow-bread*. For beauty *C. Persicum* is far ahead of any other species; and between thirty and forty years ago, or even longer, florists turned their attention to this charming plant, and began to improve it by obtaining seed, which it produces with some freedom; and they gradually laid the foundation of the splendid large-flowering varieties we see in the present day. And not only have the varieties greatly improved, but a much better system of culture has been originated; and now, instead of, as in the old times, having somewhat spare plants bearing a few flowers in March, April, and May, our florists have plants of robust, healthy growth, in bloom in November and December, and they continue to flower until April and May. It is remarkable, not only how many flowers a bulb of Cyclamen, of an age that will produce bloom, will furnish, but that it flowers successively, and for a long time, while the individual blooms are lasting.

The old system of growing the Cyclamen did not develop its beauties, and the plant did not find much favour with gardeners or amateurs. Latterly, however, their requirements have become better understood, and the size and colour of their flowers have been so much improved by cross-breeding, that they have become extremely popular.

So imperfectly did the past generation of gardeners understand the culture of the Cyclamen, that when these plants went out of flower they frequently stood them out in the open, in the full blaze of the summer sun and exposed to the action of all drying in-

fluences, and gave them but little water, and less attention; or they turned them out of pots and planted them in the open ground for the summer and autumn. The last-named was the most merciful process; but one or the other of these methods was adopted to give the plants a rest, and induce them to flower the following season. We have changed all this, as will appear when present cultural directions are set forth in detail.

Many valuable properties can be claimed for our beautiful Persian Cyclamen. It is one of the most easily grown of our winter and spring favourites. It has a compact habit of growth, handsomely-marked leaves that are particularly attractive in autumn and winter; some of its varieties are remarkable for the fragrance of their flowers; it is persistent in bloom, and of all flowering plants it is one of the best for indoor decoration. We have known a specimen Cyclamen remain fresh and nice in a sitting-room for the space of five months, throwing up, as a matter of course, a succession of flowers. The only attention it demands is to have its leaves brushed over every morning with a soft camel-hair brush dipped in a little lukewarm water.

There is little difficulty experienced in raising Cyclamens from seed, but the seeds germinate slowly, and somewhat irregularly. Sometimes a plant comes up long after others have made a good start. The best time to sow seed, in order to secure as quick and regular germination as possible, is as soon as possible after it is ripe. Our market growers, who grow Cyclamens by the thousand for the market, generally make a practice of sowing their seeds in August. This gives a good start. Seed-pans are best for the purpose, and they should be filled with a compost made up of rich loam, a liberal admixture of leaf mould, and sufficient silver sand to keep it open and free. The seeds should then be dibbled in about an inch apart and a quarter of an inch deep until the pan is filled. It is a good plan to cover the surface with a thin layer of cocoa-fibre, as it serves to check rapid evaporation, and keeps the surface free from the growth of moss. The pans can be placed on a shelf of a green-house near the glass, but care must be taken to shade them from the sun. The solar warmth will be sufficient to cause the seeds to germinate; but this is helped if they can be placed on a mild bottom heat. About November the little plants will be large enough to handle, and they should then be pricked off into pots of similar soil, placing a dozen or so plants in a $4\frac{1}{2}$-inch or 48-sized pot; when large enough they should further be potted singly into small pots, taking care not to insert them too deeply in the soil. As the plants develop they should be placed in yet larger pots; those of 48 size will be large enough for them to flower in. In the latter stages of growth less sand should be mingled with the soil, and at the time of potting the crown of the corm or tuber should always appear a little above the soil. The plants need to be kept as near the glass as possible; in the summer months they do best in a cold frame. Close attention must be paid to the plants at all stages of their development.

Messrs. Sutton and Sons, in their "Amateur's Guide," say: "Never allow the seedlings to suffer from want of water, or become a prey to aphis. To avoid the latter, occasional, or it may be frequent, fumigations must be resorted to. Give all the air possible to promote a sturdy growth, bearing in mind that fine healthy foliage is the precursor of a grand bloom. In doing this, however, avoid draughts of cold air. About the end of May should find the most forward plants ready for shifting into 60-sized pots. From the end of June to the middle of July the finest plants should be ready for their final shift into 48 pots, in which they will flower admirably. The growth during August and September will be very free, and then occasional assistance with weak manure-water will add to the size and colour of the flowers. As the evenings shorten save the plants from chills, which result in deformed blossoms."

A well-managed Cyclamen bulb at fifteen months' growth from seed ought to be at least one foot in diameter, having a dense mass of thick variegated leaves standing almost erect, and the flowers not more than two or three inches above the foliage. Well-developed flowers should be broad in the petals, about two inches in length, nearly round at the ends, and having a slight regular twist in each segment of the corolla. Towards the production of such plants and flowers, let those of our readers who may contemplate growing *Cyclamen persicum* devote their best energies.

The Cyclamen is a perennial, and with due care bulbs will last for ten or twelve years, and even longer; and the second and third years, with proper attention, they make splendid specimens. Probably many would prefer to raise plants from seed every year, especially such as have little glass accommodation; those who grow Cyclamens for show purposes, or who wish to preserve certain varieties, grow their plants for two, three, or more years into quite large specimens.

It will be observed from the foregoing remarks, that from the time of sowing the seed until the time of flowering, the Cyclamen is kept constantly growing on. Now we have to deal with plants that have flowered, and to lay down directions for treating these in a proper manner. The Cyclamen is a somewhat free-seeding plant; the peculiar position of the flowers is favourable to the most complete self-fertilisation, and the seed-pods are pretty well certain to

set readily. Unless the cultivator wishes to obtain seed from particular varieties, he should remove these; but if he will have seed he should not leave more than two or three pods on the strongest plants, lest he exhaust them too much; and he must look well after it that the stems of the seed pods do not rot, which they will do, being very susceptible of damp. The plants must be kept fairly dry, but not so dry as that they will be hindered in maturing their seed. A cold frame where the Cyclamens can be placed by themselves is the best place at this stage; it should face the south or west, and if the pots can be raised above the surface of the ground, so much the better. When the seed is gathered, the plants may be kept rather dry until they begin to show signs of making fresh growths; they should then be turned out of pots, the soil shaken from the roots, re-potted in clean pots and a good soil, returned to the cold frame and kept a little close for a few days. At this stage the bulbs should never be over-potted, *i.e.*, placed in too large pots. A half to three-quarters of an inch space between the circumference of the bulb and the pot will be found quite sufficient; it may be necessary to give another shift later on, but the general rule is to place the bulbs at once in the pots in which they are to flower. As soon as the plants begin to throw up strong leaves they should be encouraged to grow vigorously, by watering as required, by giving plenty of air, and keeping them clear of green-fly, which is very injurious to the leaves when it is allowed to infest them. If the weather is hot during the months of June, July, August, and September, and the growing plants occupy a cold frame, besides watering the soil of such as are dry, sprinkle also freely overhead once in the forenoon, but it should be done with a watering pot having a very fine rose, otherwise the foliage will be bent down by the weight of the water, and eventually the leaves will not be erect and compact, which they ought to be. And in reference to watering over the foliage, this caution is necessary: never to close up the lights of the frame for the night until the leaves are quite dry, otherwise they will become drawn. Another important point is, that while the plants are in the cold frame they should never be too much crowded, but allowed some few inches between the leaves, so that air may circulate among them, and a robust growth be maintained.

A good soil for specimen Cyclamens can be made up of the following:—two-fifths coarse leaf-mould, the same quantity of very light, soft, yellow loam; one-fifth dry cow-dung, and sufficient fine white sand to prevent it from running together. The dry cow-dung should be collected in fine weather, and it would be advisable, after rubbing it small, to pour some nearly boiling water over it to kill all seeds, which are very troublesome if not destroyed in this way; or it may be baked in an oven to secure the same end. The leaf-mould should also be well moistened, mixed with cow-dung and sand; the loam should be rubbed quite fine in the hands in a dry state, mixed with the other ingredients, and then there is produced an excellent compost to grow the Cyclamen in.

The leading points in the culture of the Cyclamen may be summarised thus:—Constant and unvarying temperature, as far as it can be maintained; a moist atmosphere; abundant supplies of water, while avoiding anything like stagnation at the roots; free circulation of air, avoiding cold draughts; light in winter and shade in summer, with freedom from insect pests. These conditions well observed will keep the plants in vigorous growth from first to last, and will conduce to the production of specimens of which the cultivator may well be proud.

Two things must be mentioned in connection with the Cyclamen: one is the marvellous development of colours in late years, from deep glowing shades of crimson and purple to the purest white, many of the pink and rose varieties being especially beautiful; and the origination of a large-flowered section, known as *C. persicum giganteum*. The flowers of these are very large and of the finest form, stout in texture, and rich in colour. It was at one time feared that if the flowers gained in size there would be a drawback in point of number, but it is found that the giant type is as free of bloom as the varieties with smaller flowers. Indeed, the large-flowered forms are fast taking the place of the smaller types. They originated by means of selection, and with more than one grower. Mr. Henry Little, Messrs. Sutton and Sons, Mr. Edmonds, Mr. Clark, and Mr. H. B. Smith, have been foremost in the work of improving the Cyclamen; the last-named is an extensive grower at Ealing, and very often as many as 30,000 plants can be seen at his nursery.

Growers of the Cyclamen find a tendency on its part to deteriorate in quality, and they therefore seek to maintain and improve upon it by means of artificial fertilisation. The best time to do this is as early in March as possible, but it may be done as late as April, although it is generally considered that the later it is done after the first week in March the less chance is there of obtaining the wished-for result, as insects at that period of the year often interfere with the work of the fertiliser. When the sun shines is the best time to do the crossing, and in the following manner:—Having selected a plant as the pollen parent (and it should have good-shaped flowers and be desirable in colour), take hold of the stalk between the left finger and thumb, just below the flower, and with the right thumb strike the side of it and the pollen will be found deposited on the left thumb-nail. Then apply this pollen by means of a dry and fine

camel-hair brush to the blooms of a plant of good habit and stiff well-marked foliage, which should in all cases be indispensable in the seed-bearing plants. In performing this some care is required, as the female organs are extremely delicate, and will not admit of any rough usage. The pollen should be gently applied to the stigma, and it will be found that at least a small portion has adhered, which is all that is required. Not more than six flowers on a large plant should be allowed to seed, for if a greater number be retained the seed will be small, and the plants will soon come up above the foliage, forming quite a coronet of turban-like blooms, which last a very long time in full beauty.

It is well to grow a few from seed every year, as the corms after they become three or four years of age are scarcely worth growing, as the flowers decrease very much both in quality and quantity.

In the process of potting, the soil should be pressed down firmly, and the centre of the corm should be slightly elevated above the soil, or the

The Cyclamen.

obtained from it, in all probability, be wanting in that vigour which is at all times so important in seedlings. After fertilising the six best blooms, all others should be at once removed, and the plants put by in a shady part of the green-house, but still having as much light as possible; and no place can better suit them than a shelf protected from hot sun by wood-work about one foot or eighteen inches from the glass. The seeds ripen in about ten weeks, and they can be sown at once, as previously directed. There is a keen enjoyment in raising seedlings, the peculiar delight of which is known only to the enthusiastic and painstaking florist.

If Cyclamen bloom is wanted early, and a good succession kept, place a few at a time in a slightly warmer place, not forgetting that these plants cannot thrive in a close atmosphere. So treated, the flowers young leaves and buds are apt to decay if too much moisture is about them.

The compact habit of the Cyclamen, and the long foot-stalks on which the blooms are borne, render them very useful for winter and spring decoration, either as pot plants or when their flowers are cut for the embellishment of the house.

There are some named varieties of the Cyclamen: indeed, new varieties bearing names are being introduced every year. But they are not sold, because the old system of propagation by means of dividing the corms has been abandoned. But finding that seed from many of these will reproduce the variety, cultivators offer such seed for sale, and a few, at least, of the leading varieties will be found in the catalogues of most seedsmen.

THE VINE AND ITS FRUIT.

By William Coleman.

KEEPING AND PACKING GRAPES.

Keeping Grapes through the Winter.—To keep grapes through the winter, they should be thoroughly ripe by the end of September. Small bunches keep better than large ones, and these should be more severely thinned than summer grapes, as it is necessary for the air to have a free passage through the centres to prevent condensation of moisture on the berries. If the roots have the run of internal and external borders, the first should be well watered as soon as the grapes begin to colour, when a mulching of short dry manure may be laid on the surface to keep in the moisture, and so feed the roots until the foliage is ripe. The leaves should be kept on the vines as long as possible; but when they begin to fall, their daily removal will be necessary, as decaying vegetable matter always engenders damp, which soon affects the berries. When all the leaves have been cleared away, let the whole surface of the border be well covered with dry bracken as an absorbent of atmospheric moisture, and to prevent dust from rising and settling on the berries. Avoid sweeping the floors when very dry; never admit a pot-plant that will require water, and dispense with fire heat as much as possible, consistent with the maintenance of a temperature ranging from 45° to 50°. Look over the bunches every week for decaying or defective berries, and ventilate freely, with fire heat turned on when the external atmosphere is dry and the warmth of the house is not likely to draw in moisture. In damp, cold weather keep the house close, and, if possible, almost dispense with fire heat, as a temperature of 40° will not hurt the grapes if they can be kept dry. If on such days gentle warmth is found necessary, leave a crevice on each light open at the top of the house; but on no account open the front, as a circulation would draw in a stream of moist vapour. In low, cold, damp situations, these precautions are of more importance than on high, dry soils, hence the advantage of starting all late houses early in the spring so as to avoid much autumn firing, which does more harm than good, as grapes so ripened never keep well. External borders should be well covered with dry bracken, before the summer heat is drawn or washed out of them; and glass lights, shutters, or, best of all, sheets of corrugated iron, placed above and not touching the fern, to keep out snow and rain. In this way grapes can be kept in good condition until March; but this system is now superseded by bottling and keeping the fruit in a properly arranged grape-room.

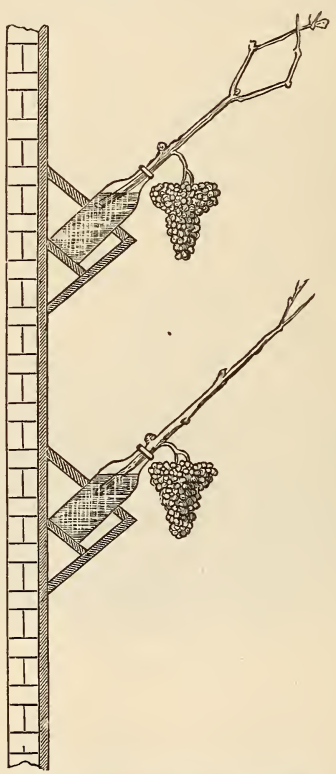


Fig. 22.—Keeping Bunches in Bottles.

Preserving Grapes in Bottles of Water.—We are indebted to the French for this excellent system, by means of which the late kinds of grapes can be kept fresh and plump, and perfect in flavour, until the end of May. In order to insure success, it is important that the grapes be thoroughly ripe by the middle of September, when the treatment recommended in the preceding paper will apply until Christmas, or the first week in January. As nothing can be gained by allowing them to hang after this date, the room in which they are to be preserved should be prepared some little time in advance, and well fired to expel damp after the bottles are filled and placed in position. To those who have not had experience in the construction of a grape-room, the following hints may be of service. Any dry, airy, well-ventilated store-room (if with hollow walls and ceiled roof, so much the better) will answer the purpose, the great object being the maintenance of a dry, equable temperature, without having recourse to much fire heat. The bottles should be placed in racks, tier above tier, secured to an inner wall, and they should lean forward at an angle of about 45°, as in the annexed engraving (Fig. 22), so that the bunches may hang without touching the rack or each other. A small, slow combustion boiler placed outside, with a flow and return pipe inside for expelling damp, and keeping up the proper degree of warmth in very severe

weather, will be necessary; but fire heat is not an essential, provided the room can be kept dry, and a temperature of about 45° maintained without it. Having filled and placed a sufficient number of ordinary wine bottles with soft water, and heated the pipes for several days in succession, to dry the walls and floor, on a dry, fine day cut the grapes with all the wood close to the base or pruning bud; carry them steadily to the room, insert each piece of wood in the bottles, and place a small piece of wadding in the necks to prevent evaporation. Do not shorten back the pieces of wood beyond the bunches, as every fresh cut allows the water to pass in the form of invisible vapour into the air of the dry room, and constant filling up is objectionable. Lady Downes, Mrs. Pince's Muscat, Black Morocco, and White Tokay, being the best for keeping after March is out, they should be placed in the upper tiers; then should follow Gros Colmar, Alnwick Seedling, Black Alicante, Wests, St. Peters, Trebbiano, and Muscat of Alexandria, for use from January up to the end of March. It will be necessary to look them over occasionally for decaying berries; but if all defective berries are removed at the time of cutting, the grapes will keep much better in the room than on the vines, provided the bottles are kept filled up with soft water.

When all the grapes are cut and the vines are relieved of a strain almost equal to that produced by early forcing, they can be pruned, cleansed, and allowed a good two months' rest before they are again excited into growth. Where late Hamburghs are in demand, all that are hanging on the vines in October may be removed to the grape-room, where they will keep fresh and good, and with less loss than if left on the vines until the end of the year. Some grape-growers put a small piece of charcoal into the bottles; but this is not necessary, as many years' experience proves that the grapes keep just as well without it; but when a portion of the grapes have been used, it is a good plan to empty and fill up their bottles with fresh water, and transfer the Lady Downes to them. Muscats and Gros Colmar should be thoroughly ripe some time before they are cut, and if one part of the room is drier than another they should have it, as the Colmars are liable to mould, and the fleshy stalks of the shoulders sometimes suffer from the moisture contained within themselves.

Preserving Grapes in Troughs.—This is a modern invention, patented by Mr. George Ward, the well-known grape-grower of Bishop Stortford. As yet it is too early to say whether the troughs are a complete success, though, judging from their extreme simplicity, and the fact that Mr. Ward is satisfied after long trials, there seems little doubt that they will soon be found in general use.

The troughs, which are oblong in shape and seventeen inches in length, are single, as in Figs. 23 and 24, or double, as in Figs. 25 and 26. The material used in their manufacture is glazed earthenware, which possesses the advantage of being non-porous, cheap, and cleanly. Each single trough is made with a flange against one of its sides; there is also one running along the middle of the double troughs, the use of which will be readily seen. The trough is filled with water nearly up to the brim. The shoot bearing the bunch is cut back full length to the pruning bud to admit of its hanging free of the trough, while the end of the shoot is inserted under the flange F. The shoot acts as a lever, working on the edge of the trough as a fulcrum, and the weight of the bunch keeps it in position by pressing it firmly under and against the flange F.

The following are some of the advantages which Mr. Ward claims for his invention:—The troughs do not require tilting, and yet the grapes hang in their natural position. They need not be full, as there is no danger of the ends of the shoots becoming dry; the water keeps sweet, and there is no fear of drip. Water can be added without removing the grapes. No tying or fastening is required, and each bunch may be lifted out and replaced at pleasure.

The single troughs are made for fixing against a wall in tiers fifteen inches apart, one above the other, and are supported on L-shaped iron holdfasts, which retain them in position, but admit of their removal for cleansing and other purposes. Fig. 23 shows the appearance on the wall and Fig. 24 shows, on a larger scale, a section through the trough. The double troughs are made for fixing on stands specially constructed for the purpose; the latter may be made any length and to contain any number of tiers, and placed in convenient positions in the grape or store-room. Each shelf s (see Fig. 25) is made with a ledge LL on either side to hold the trough in position. Fig. 26 gives a view of the stand and troughs, and Fig. 25 shows an enlarged section of one shelf and trough.

The Packing of Grapes.—The packing of grapes for transit by rail, often to a considerable distance, is a matter which requires a greater amount of attention than is frequently given to it. Many cultivators produce excellent fruit, but very often damage or completely spoil it through not knowing how to pack. The great art of packing, not only grapes, but all sorts of tender fruit, either for market or private use, is more than half attained when the young beginner gets over the fear of packing too tightly, for if once allowed to move or change

their position after the boxes are handed over to the tender mercies of a railway company, the contents suffer to an extent that greatly depreciates their value. Some growers use baskets that will hold from eighteen to twenty pounds each, and four of these, when packed in a case of suitable size with handles

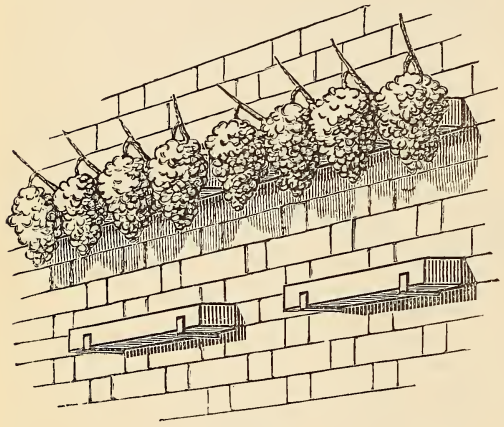


Fig. 23.

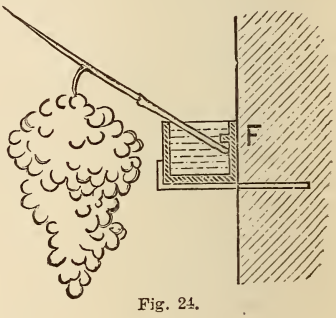


Fig. 24.

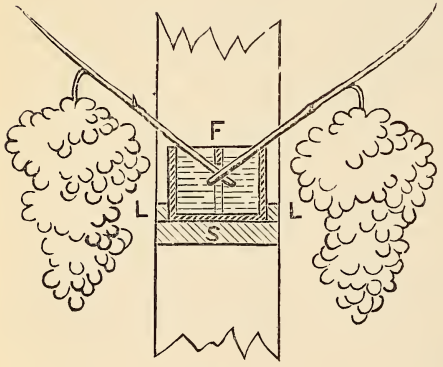


Fig. 25.

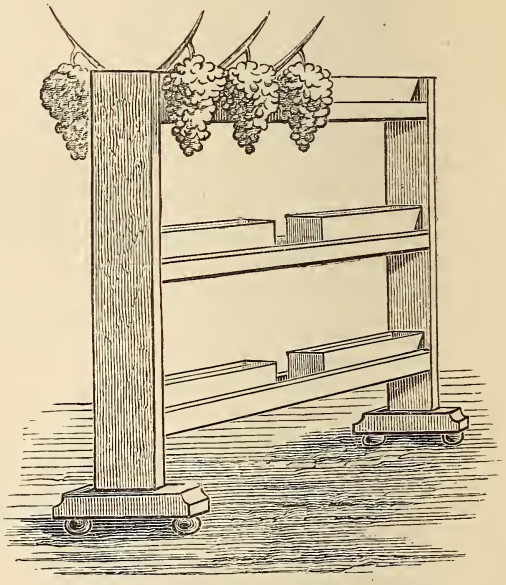


Fig. 26.

at each end, make up a weight that protects them from being turned over by the railway porters. For private growers, boxes of uniform size that will hold from eighteen to twenty pounds each are best; indeed, boxes that will just hold the quantity required are preferable to baskets, as they do not so readily give way to pressure. These should be made of half-inch deal, twenty-four inches long, fourteen inches wide, and six inches deep. The best material for general packing is dry, soft moss, of which a large supply should be obtained when the weather is fine, thoroughly dried, and beaten with sticks to destroy the harshness and free it from dust. Having the boxes and moss at hand, proceed by placing a layer an inch or more thick evenly over the bottom of the box, line the box, sides, ends, and bottom, with a double thickness of cap paper and a single thickness of silver paper, allowing one half of the sheets to hang over the sides for turning over when the packing is finished. Weigh the box, carry it to the vinery, placing it in a slanting position by raising one end to an angle of 45°. Commence packing by placing good bunches in each of the lower corners, keeping the shoulders well up to the

level of the sides, select a third bunch that will fit in tightly between the other two. Proceed in this way until the box is half full, then raise the box to a sharper angle, and press the bunches still closer together; finish cutting, reserving three short clumpy bunches for the last row; return to the grape room, take the gross weight, deduct the weight of the box, and write the nett weight on a card.

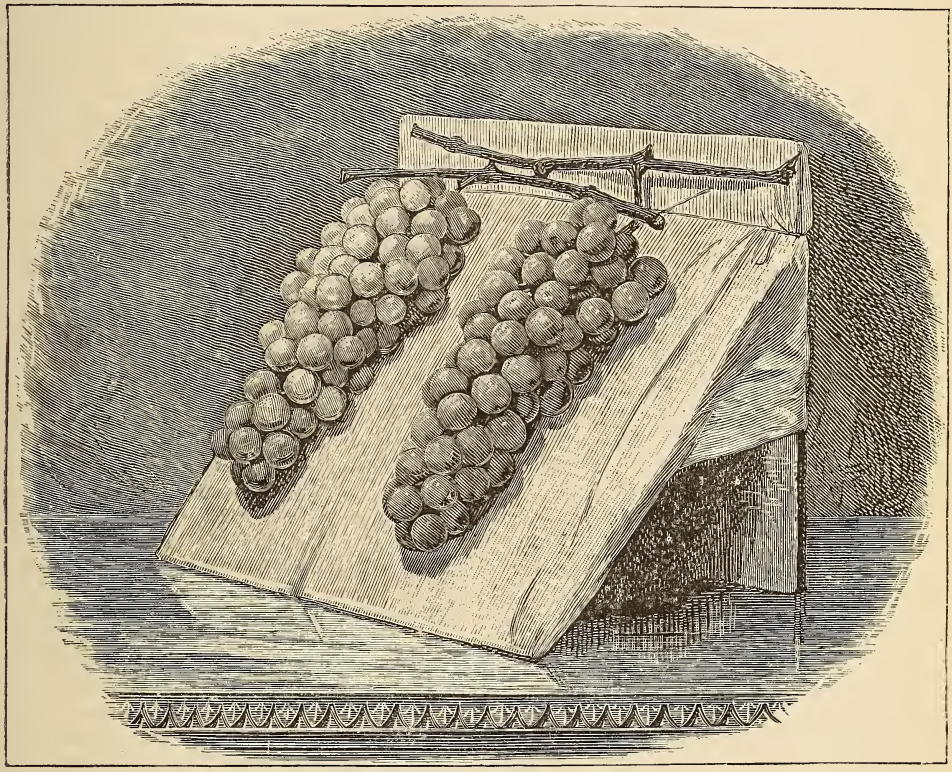


Fig. 27.—Grapes Staged for Exhibition.

Place the box flat upon the table, get a supply of moss near the right hand, and commence wedging the grapes away from the sides by the introduction of small quantities of moss into the cavities formed by drawing the three thicknesses of paper inwards; gradually work round, constantly drawing the paper inwards until the berries begin to show signs of rising out of the box. Strain a sheet of paper over the top, secure the card containing the weight with a tack. Turn up the paper from the outside, and secure the lid. Some gardeners place moss or wadding over the paper, and thus take all the bloom off the shoulders. Nothing more than a sheet of paper should be placed between the grapes and the lid, the pressure of the elastic moss keeps every berry in its place, prevents the loss of bloom by friction, and the stalks which stand upwards prevent the shoulders from touching the lid.

The preceding directions apply to Hamburghs; Muscats being more tender require greater care, and the less they are handled the better, as any undue pressure or friction causes them to change colour when opened and exposed to the air. They must, however, have sufficient packing to prevent them from moving in transit. If the bunches are very large it may be necessary to use wider boxes, but they need not be deeper. Having prepared the box by laying two inches of moss at the bottom, line the sides and ends with strips of wadding folded in silver paper, and proceed as before by tilting the box to a sharp angle. Place a double sheet of silver paper in the lower angle, allowing two-thirds to run along the bottom. Cut the first bunch, lay it lengthwise across the box, turn up the ends of the paper, and draw them with

both hands over the bunch towards the lower end. Then take a strip of wadding, four inches by twelve, place it against the bunch to form a division; lay in another double sheet of paper, and proceed by laying the next bunch with the shoulders in the opposite direction, turn up the ends of the paper as before, and draw the second bunch close to the first. Add another strip of wadding, and repeat until the box is full, when by raising it to a sharper angle the weight of the fruit, aided by very slight pressure with the fingers, will make room for another bunch. Fill all vacancies round the sides by forcing moss between the wood and the lining; fold the upstanding ends of the paper evenly over the fruit, secure the lid with two small nails, enclose the record of the weight, and cord each box singly or two together. Wadding must be used with great care, and on no account be put in contact with the grapes.

Lady Downes, Alicantes, and other kinds having long, tapering bunches, may be treated as Muscats, placing them transversely across the box; but it is not necessary to place anything between them, as they are less susceptible to bruising; indeed, the tighter and closer these kinds are pressed together the better they travel. Lady Downes, unless very fine indeed, do not require a six-inch box; but it simplifies the matter of packing if all the boxes are of uniform size, and the unnecessary depth may be reduced by increasing the thickness of the layer of moss at the bottom. The bunches of the kinds that lie transversely across the box should not, however, touch the paper, which should be drawn tightly over the top of the box, and retain its position by being nailed down with the lid.

The key-stone of success in adopting the foregoing system lies in the use of dry, soft moss, the cheapest and best material for general packing, and this should be forced down between the sides of the box and the paper until it begins to form an arch near the lid, when the boxes may be turned upside down without injury to the grapes.

Grapes for Exhibition.—Experienced exhibitors and observant visitors to the great fruit shows are often pained by the untidy way in which good examples of grape culture are sometimes set up, or the careless manner in which they are conveyed to the tents. The grape-grower who wishes to succeed must not only be able to finish his fruit on the vines, but must also be able to convey it without spot or blemish to the most distant part of the country. He must not be above spending a night with his cases in a luggage van, neither must he be afraid of showing a firm front when hasty midnight changes take place on crowded platforms. Visitors to the great exhibitions little think of the watchful care and anxiety which have been devoted to the transit alone of a stand of spotless grapes; and as many of our *confrères* seem little better informed, a few hints on setting up and exhibiting may not be out of place.

Years ago it was the custom to show grapes on dishes or in flat boxes, but now they are invariably set up, or rather suspended, on stands specially prepared for the purpose (Fig. 27). The bunches, it will be seen, are resting on a sloping board or stand, some fourteen to eighteen inches in height, and of convenient length for carrying from one to three bunches. When a greater number of bunches form one exhibit, it is best to use two or more stands of uniform height, as three or at most four bunches are sufficient for one stand. In order to show the grapes to the best advantage, and to convey them with the greatest degree of safety, the sloping part of the stand should be more upright than they are sometimes made, as there is then less danger of the berries moving or the shoulders of the bunches falling back on the stand. The sloping part of the stand should be first covered with a sheet of wadding, and then with a sheet of silver paper for black grapes, and pink paper for white ones, neatly turned under the edges, and secured with small tacks. The bunches are cut with a piece of the wood on which they have been growing, and are transferred at once to the stands, where they are secured by means of a piece of strong string or tape passed round the stalk and through the two holes in the back. This string, be it borne in mind, should be tied tightly round the stalk at the junction with the wood, so as to preclude all possibility of chafing in transit; the ends are then passed through the two holes, and tied at the back. When set up the bunches should be about three inches apart to admit of inspection; they should be suspended with the flattest side to the board and, it is hardly necessary to say, with the best side facing the judges. A bunch should never be lifted after it is suspended, as with the greatest care it cannot be done without disturbing the bloom. Some writers on packing for exhibition advise passing a piece of string through the berries and round the stem about the middle of the bunch, thence through two holes in the stand; but this is a troublesome and unnecessary operation, which cannot be performed without removing the bloom. Moreover, it is a dangerous precaution, as any sudden jerk in transit is likely to cause the stems to snap where the string passes over them. Large bunches having heavy shoulders may sometimes have wads of cotton wool placed under them; beyond this no packing of any kind must be used. When all the grapes are cut and arranged on the boards, fit them into the cases in which they are to travel to the show.

These should be made of half-inch deal, just large enough to take in the stand and clear the fruit when the lid is secured; pass two screws through the case from the outside into the back or upright part of the stand to keep it from working forward, and so placing the points of the bunches in contact with the cases; put on the lid, and secure it with a stout strap like a stirrup leather. If passed round the middle, the straps offer facilities for carrying the cases, and they can be quickly removed when time is of importance. When removing the cases great care must be observed in keeping them level, as a turn over would be fatal. Many exhibitors never lose sight of their boxes, or allow them to pass out of their hands; but if kept level, grapes worth exhibiting will stand more shaking than many people imagine.

VINES IN POTS.

Fruiting Vines in Pots.—In large grape-growing places this mode of culture has fallen into neglect, as good winter grapes can be kept over the period at which the fruit from pot vines was formerly considered of value. Where late winter grapes are not grown, and it is necessary to get an early supply of new ones, or where newly-planted houses afford room for growing a set, they often come in very useful, as well-prepared canes readily respond to forcing. But where a structure is specially devoted to them, a low span-roofed house or pit answers best, provided it is light, well glazed, and heated, as it is less expensive in fuel, and where the demand is not heavy a few pots will often save a permanently planted house for later and more certain use.

Although pot vines ready for forcing can be purchased by the thousand, gardeners always prefer growing their own when they have convenience for doing so, and as this entails the use of two houses for one crop of fruit, the system cannot be recommended on the score of economy. To many, however, it is interesting and instructive, as it enables them to grow and test many varieties, which, under other conditions, they could not do. Some good cultivators grow their vines from eyes one year and fruit them the next under the treatment explained in the chapter on the Propagation of the Vine; others use cut-backs, which make stronger growth, but it is questionable if they are better than well-ripened yearlings.

The varieties best adapted for forcing are Black Hamburgh, Madresfield Court, Alicante, Foster's Seedling, Duchess of Buccleuch, and White Muscadine. All the Frontignans also do well in pots.

Vines for pot culture should always be ripened early, and if forcing is to commence, say in November, they should be cut back to the required length by the end of September or earlier, if they have lost their leaves before that time. As a moist, mild bottom-heat is of importance, provision should be made for surrounding the lower parts of the pots with fermenting material, but as leaves or tan keep sinking and drawing the pots away from the trellis, the latter should be placed on firm pedestals or shelves, an arrangement which will admit of turning and renovating the material when it gets too low or the heat begins to decline. Having washed the vines, enlarge the holes in the pots with a hammer to set the crock roots at liberty; place each vine on a sod of good turf laid grass downwards on the pedestals, and introduce the fermenting material loosely at first and partly burying the lower parts of the pots. Defer tying up the canes and allow them to hang loosely over the bed, with the back buds raised to the highest part of an arch, and the points on a level with the rims of the pots. Syringe regularly three times a day, and give the temperature recommended for starting early vines. Water very sparingly at first, as too much would make the soil sour, and most likely rot many of the roots. Raise the temperature of the pit to 60° by the time the buds break, and gradually increase the heat to 68° by the time the bunches come into flower, allowing a daily increase of five degrees from fire heat and ten degrees from solar heat when the weather is favourable. Discontinue direct syringing after the bunches become prominent, but on no account neglect the supply of water to the roots, as pot vines in leaf will take liberal supplies of warm, clear diluted liquid or guano water at short intervals.

When all the buds are thoroughly on the move, decide upon the mode of training. Some coil them round four sticks placed in the pots, but the most simple way is to tie them up to the trellis like ordinary vines, as the side shoots can then be tied out and stopped at the second joint beyond the bunch, and the latter are most conveniently placed for thinning. If they show freely, remove all the bunches that are not likely to be wanted, as overcropping is fatal. Stop all laterals on the shoots carrying bunches, but lay them in from the others after the first stopping, wherever there is room for foliage to expand to the influence of sunheat and light. Top-dress from time to time with lumps of turf, manure, and bone-dust in moderation; also spread a little about the sods when the roots have found their way into it, and keep the bottom-heat at their level at 75° to 80°. When the stoning stage arrives, slightly reduce the night-heat to 65°, to give them a little rest during this trying process; but raise it again to 68°, if time is an object, when it is over.

Pay regular attention to ventilation from the beginning, keeping the house rather dry and warm,

with a constant circulation during the time the vines are in flower; but close early at all other times, with an abundance of sun heat and moisture. If any of the vines miss fruiting, remove them at once to practise semi-extension by laying in the sub-laterals from those carrying full crops of fruit. Increase the air and reduce moisture when the grapes begin to colour, but never allow the vines to feel the want of water at the roots.

Pot Vines for Table Decoration.—These pretty objects are prepared by passing a well-ripened rod through the bottom of a small pot while

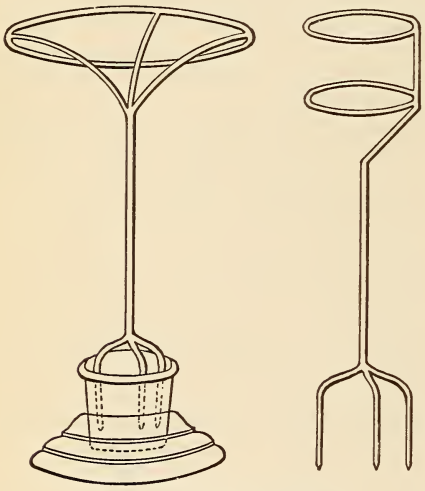


Fig. 28.—Trainers for Pot-Vines.

it is attached to the parent vine, and allowing it to root into rich compost with which the pot is filled when the vines are pruned. The rod selected should be furnished with eyes that are likely to break well and show plenty of fruit, and it may extend from one to two feet above the top of the pot, where it must be secured to an upright stick or tripod (Fig. 28), firmly fastened to the rim. As the buds break, all below the pot are rubbed off or closely pinched, while those above are stopped at the second joint beyond the bunch and tied out to a light wire trellis or hoop fixed at the top of the centre stick. If properly tended with water the pot will be well filled with roots by the time the grapes are ripe, when the canes may be cut through by degrees close to the bottom of the pot, and the established fruit-bearing plant will be ready for use.

Fig. 29, on the next page, is a sketch from a pot vine grown by Mr. Sage, late gardener at Ashridge. This was prepared by taking a long rod through the bottom of a pot, leading it up the centre stick, thence round a circular or parasol-shaped wire trellis, before the buds broke. The young growths and leaves were then trained regularly, but not crowded; the bunches were good, and the effect was artistic and excellent.

When preparing plants in this way it is important that the yearling-rod be coiled in its proper place before the buds break, when every leaf will expand with its face to the light, and the shoots can be pinched or extended so as to fill every part of the trellis with its foliage, an evenly-balanced head being all-important. When coiling is deferred until the fruit is ripe the vines do not look happy, as the foliage never takes a natural position, and the bunches get rubbed and disfigured under the operation. A little selaginella planted on the top of the pot and grown on with the vine gives it a nice finish when the fruit is ripe.

VARIETIES OF GRAPES IN GENERAL CULTIVATION.

1. **Alicante.**—This is a very handsome, easily-cultivated, vinous grape, and has been largely cultivated for market and exhibition, but in many places it is now superseded by Gros Colmar, which commands a better price. It is only second-rate in quality, and is best suited for late use, coming in as a useful link between the latest Hamburghs and Lady Downes. It succeeds under Hamburgh treatment; always sets and colours well; and is improved by hanging after the leaves fall from the vines. Mr. Meredith, late of Garston Vineyard, brought it into note, and by his excellent and extensive cultivation it soon became known as Meredith's Alicante.

2. **Alnwick Seedling.** — A very handsome, oval, black grape, of free habit and good constitution, but only second-rate in quality. It is one of the best late-keeping grapes of recent introduction, requires a high temperature when in flower, and careful fertilisation with the pollen of some other variety to ensure its setting freely. It always colours well, and is in good condition from Christmas onwards. It was raised at Alnwick Castle; but to Mr. Bell, of Clive House, is due the credit of bringing it out in its true character.

3. **Black Hamburgh.**—This grape is too well known to require description. It is unsurpassed as an early grape, and is the best of all for a general crop, being of extremely easy cultivation, and first-rate in quality; but unfortunately the majority of growers cut it before it is in its best condition. This gardeners' friend was introduced from North Germany about the beginning of the last century, and is known in this country under many synonyms. The fine old vines at Cumberland Lodge, Hampton Court, Finchley, Shardloes (Bucks), Eastnor Castle,

Sillwood Park, and Kinnell, in Scotland, are Black Hamburghs. Mr. Meredith, when at Garston, grew a bunch weighing 9½ lbs., and Mr. Hunter, of Lambton Castle, has produced bunches weighing

In addition to the above, we have Champion Hamburgh, Mill Hill Hamburgh, and Frankenthal, which many consider distinct varieties. The varieties with medium-sized oval berries are the

Fig. 29.—Vine in a Pot for the Table.

13 lbs. 2 ozs. and 21 lbs. 12 ozs. It is to be regretted that this fine grape cannot be had in condition all the year round. The berries do not, however, keep good on the vine after the beginning of December; but they can be preserved in fair condition until the end of January, if cut and bottled as soon as the foliage is ripe.

best for eating, while the large hammered-berried variety, known as the Dutch Hamburgh, is the most telling for exhibition.

4. **Black Morocco.** — This fine black oval variety, when well grown, is one of the best, as it is one of the most handsome, winter grapes in cultivation; but unfortunately it does not set well. Mr.

Barron says this is "one of the worst setting grapes known;" but with me, on the north side of a Muscat house, it sets as freely as a Hamburgh. It rejoices in plenty of heat, and requires careful fertilisation with Hamburgh pollen. The bunches and berries are large, and it keeps well in a dry room till the middle of April. In Worcestershire it is known as the Kempsey Alicante.

5. **Black Prince.** — A handsome, free-setting, Sweetwater grape, but only third-rate in quality. The bunches grow to a great length, and the berries always colour well. One vine may be planted in large collections for exhibition purposes, but it is an old variety that is superseded by many kinds that are infinitely superior.

6. **Buckland Sweetwater.**—An English seedling of handsome appearance, and worthy of a place in every early vinery. It succeeds well under Hamburgh treatment, and fruits best when trained on the long-rod system, but in some soils it is rather shy. When the berries assume a rich golden colour, they are of good flavour and very refreshing. It is a good early exhibition grape.

7. **Canon Hall Muscat.** — A large, round-berried, handsome grape, when well grown; but as it does not set well, perfect bunches are rarely met with. The vine is not so good a grower as the Muscat of Alexandria, being gross, pithy, and often badly ripened; neither is the quality of the fruit equal to that fine old variety. The last generation of gardeners always made a point of planting it, but it is now seldom met with.

8. **Dr. Hogg.**—A splendid, round-berried, Muscat-flavoured grape, of the Chasselas or Frontignan quality. It was raised by the late Mr. Pearson, of Chilwell, and is now grown in every garden where those delicious grapes are appreciated. The bunches grow to about twelve inches in length; the berries are larger than those of the Frontignan, and, unlike the Chasselas Musque, they never crack when ripening.

9. **Duchess of Buccleuch.**—This delicious Muscat-flavoured grape was raised by Mr. Thomson, of the Tweed Vineyard. The bunches grow to a great length, and the berries set well; but being rather small they detract from its appearance. It is a free-setting variety, well adapted for pot culture, and requires a little more heat than the Hamburgh. When grown, as the raiser has grown it, it is well worthy of a place in all choice selections of Muscat grapes.

10. **Duke of Buccleuch.**—This is another of Mr. Thomson's seedlings, but as it belongs to the Sweetwater section, it is only fit for early or summer use. When well done, it is one of the most noble grapes in cultivation. The flesh is tender, rich, and juicy; and the berries, which are very large, take a rich amber colour when fully ripe. The vine is a very strong grower, and does best in a warm internal border. With some growers the berries are subject to spot.

11. **Foster's White Seedling.** — An oval, white, Sweetwater grape, of good quality, and invaluable for early forcing. It was raised by Mr. Foster, of Benniborough Hall, Yorkshire, who from the same potful of seedlings also raised the well-known Lady Downes. With the exception of the Muscat, this is one of the best white grapes in cultivation. It ripens well under Hamburgh treatment, and is invaluable as an early exhibition grape.

12. **Golden Champion.**—This fine, large, oval, white, Sweetwater grape was raised by Mr. W. Thomson, and is a noble acquisition where it does well. Having a weak constitution, it should be worked on the Hamburgh, and trained on the long-rod principle. Mr. Webb, of world-wide fame as a manufacturer of ornamental glass, grows magnificent bunches of this grape in the centre of the town of Stourbridge. A liberal admixture of siliceous refuse from the works is introduced into the borders; the vines grow well, and the berries are free from spot.

13. **Grizzly Frontignan.**—This is one of the most delicious Muscat-flavoured grapes in cultivation, and should have a place in warm internal borders in early and mid-season houses. The vine is a moderate grower, and well adapted to pot culture. The berries, like all the Frontignans, are rather small, but they set freely, and ripen well under Hamburgh treatment.

14. **Gros Colmar.**—A very large, round, black, vinous grape, extensively grown for market. The vine is robust, and sets its fruit freely in a Hamburgh house, where, if properly thinned, the berries swell to an enormous size; but it takes a long time to ripen, and is not in its best condition until some time after the leaves fall. To do this handsome, but by no means rich, grape well, it should be grown in a warm, mid-season house, where it can hang for some time after the other grapes are cut, and then be removed to a warm grape-room, where it will keep until the end of March. As the berries frequently measure 4½ inches round, they should be liberally thinned.

15. **Gros Guillaume.**—This is frequently met with under the name of Barbarossa, and is, as is well known, one of the most uncertain grapes in cultivation. It fruits best on the long-rod system, and requires plenty of heat to ripen up the wood; otherwise it is shy and capricious. The fruit is only third-rate in quality, unless very highly ripened; but the bunches are large and handsome, and the grapes keep well until the end of March. It fruits well in and around Stratford-on-Avon, where the

late Mr. Butcher was the first to bring it into notice. The largest bunches have been grown by Mr. Roberts, Charleville Forest, Ireland, the heaviest cluster weighing 23 lbs. 5 ozs.

16. **Gros Maroc.**—This is an oval black grape, of first-rate quality, and handsome appearance. It is difficult to propagate; but once established, it grows and fruits freely under Hamburgh treatment. The fruit, when hanging on established vines, might be taken for Gros Colmar; but, unlike that variety, it is fit for use as soon as it is ripe, and the flesh being more tender, it neither travels nor keeps so well. Where fine grapes of good quality are wanted, either for private use or exhibition, a vine should be planted in all early and mid-season houses. The berries swell to a large size, and require liberal thinning; they also colour well, often under unfavourable conditions.

17. **Lady Downes Seedling.**—This invaluable black winter grape is too well known to require description. When well grown and thoroughly ripened, the fruit will keep fresh and plump in the grape-room until the end of May—five months after the bunches are cut from the vines. It requires a long season of growth, and, being a late starter, should be coaxed forward with fire heat in the spring. It also requires a high temperature to set the berries properly; indeed, like all our best winter and early spring grapes, it does best in a temperature very little, if any, lower than that given to Muscats. Nine-tenths of the Lady Downes grown are never properly ripened, and consequently neither keep well nor give satisfaction.

It is a remarkable fact that the terribly condemned Black Morocco should be the parent of three of our best English seedlings—viz., Madresfield Court Muscat, Foster's Seedling, and Lady Downes, and that the second is the best early white, while the third is unquestionably the best late black, grape in cultivation. What is still more remarkable, the early white and the late black came from the same potful of seedlings.

18. **Madresfield Court Muscat.**—This exquisitely-flavoured grape was raised by my lamented friend, Mr. Cox, and was sent out as a late variety, its parents being Muscat of Alexandria and Black Morocco. As a natural consequence, it was condemned as a bad keeper; but now it has, by its excellence, forced its way into the early and mid-season houses, its qualities are appreciated. It is extensively grown for early market, but it will not keep for any length of time after it is ripe, and, like its capricious male parent, it sometimes shows a disposition to crack. Mr. Roberts, of Gunnersbury, grows this variety remarkably well.

19. **Mrs. Pearson.**—A round, white, Muscat-flavoured grape, of very superior quality, raised by the late Mr. Pearson, of Chilwell. The vine is a good grower, shows plenty of bunches, and sets its fruit freely. Where two kinds of late white grapes are wanted, this will be found a valuable acquisition. It requires, however, quite as much time and as high a temperature as the Muscat to bring out its best qualities. When thoroughly ripened, it promises to become a good grape for bottling.

20. **Mrs. Pince's Black Muscat.**—Like all the thick-skinned winter grapes, this fine variety requires warm treatment and a considerable time to ripen up the fruit. The bunches grow to a large size, but the berries do not always set well, and it is a difficult grape to colour. When well ripened this is one of our best late grapes, and keeps fresh and plump up to the end of April.

21. **Muscat of Alexandria.** — This is undoubtedly the most handsome, as well as the most valuable, white grape in cultivation. The vine is a good grower, shows an abundance of bunches, and sets its fruit fairly well when the roots are in a satisfactory condition in a warm border. The majority of growers who aim at good culture always give this universal favourite a house to itself, as it requires a high temperature when in flower, and again to ripen up the fruit and wood. To ensure a perfect "set," the flowers should be fertilised with pollen from the Hamburgh. When well ripened and properly coloured to a bright amber under the direct influence of plenty of sunshine, this is the king of grapes, and if cut and bottled in December will keep until March.

22. **Muscat-Bowood.** — Although this might not be a true cross, it is a valuable grape, of excellent constitution. It was raised as a seedling by the late Mr. Spencer, of Bowood, and, like many others, it differs from the parent in being a little earlier, and setting and finishing in a lower temperature. Where the old variety does well, this is not an acquisition.

23. **Muscat-Hamburgh.**—An old friend under a new name, but none the less a first-class variety when it can be induced to set well. It was formerly known as the Black Muscat, and when well grown is one of the most delicious grapes in cultivation. One vine at least grafted on the Hamburgh should be in every collection, where it will do better than on its own roots.

24. **Raisin de Calabre.** — A round, white grape, of very indifferent quality, valuable for its late-keeping qualities. The vine is a good grower, and does well in a late house, for which it is best adapted. One vine may be planted in a large collection.

25. **Royal Muscadine.**—A round, white, Sweetwater grape, of excellent quality, and easy cultivation. It grows and fruits well in a cool house; is an abundant bearer, and keeps well after it is ripe. This is one of the most useful vines for amateurs, and is well adapted for pot culture.

26. **Syrian.**—A large, coarse, white grape, now rarely met with. It requires plenty of room, and should be grown in a well-drained border, as the wood and fruit require a long time to ripen. After long exposure to the sun, the berries are passable; but no one now thinks of planting it. It is mentioned here, as it is supposed to be the variety which the Spies found in the Land of Promise. Speechley, of Welbeck, grew a bunch weighing 19 lbs.

27. **Trebbiano.** — Very similar to Raisin de Calabre; a handsome, white, late grape, of second quality, only valuable for its keeping qualities. Mr. Curror, of Eskbank, in 1875, grew a bunch, the heaviest on record, weighing 26 lbs. 4 ozs. If the vines have plenty of space, and the grapes are allowed to ripen and hang for a long time in a high temperature, they will keep good until the end of March. One vine may have a place in large collections.

28. **Venn's Seedling.**—An excellent black, Muscat-flavoured grape, supposed to be a seedling, but not a cross, from Muscat-Hamburgh. However this may be, it sets and swells better than many, and having a thicker skin and stouter footstalks, it keeps longer than the parent. It succeeds, too, where the Muscat-Hamburgh is a failure.

29. **West's St. Peters.**—A first-rate, old, late-keeping, black grape, still worthy of extensive cultivation. The bunches and berries are of medium size, and on this account well adapted for keeping. When well ripened, under Lady Downes treatment, it will keep well until the middle of March. In point of quality, it is little inferior to the Hamburgh, which it succeeds.

30. **White Frontignan.**—This, like all the neglected family, is one of the most delicious, musk-flavoured varieties known to grape-growers. It does well with Hamburghs, and requires exposure to the sun when ripening. It is an excellent variety for fruiting in pots.

31. **White Nice.**—A white, vinous grape, of second quality. The bunches are large and ugly. The berries, which are of medium size, set well, and require a long period, under warm Hamburgh treatment, to bring them up to a presentable condition. Where large exhibition bunches are wanted, a vine should be planted. Mr. Fowler, Castle Kennedy, has grown it 17 lbs. 2 ozs., and Mr. Dickson, Arkleton, has produced clusters weighing 18 lbs. 7 ozs., 19 lbs. 5 ozs., and 25 lbs. 15 ozs.

32. **White Tokay.** — This is an oval, vinous grape, of first-rate quality, well worthy of a place in every late house. It can be grown with mid-season Hamburghs, where it can hang to finish after the latter are cut from the vines. When the berries become of a rich amber colour, and the leaves have fallen, it can be kept for a long time in the grape-room.

THE FLOWER GARDEN.

By William Wildsmith.

THE "MIXED" STYLE.

BY the term "mixed style" is meant not only the cultivation of hardy flowering herbaceous perennial plants (these principally), but these combined with suitable dwarf shrubs and hardy carpeting plants, such as Sedums and Saxifragas, and even some plants of a tender nature, which, in the summer season, can be grouped in vacant spots, and add greatly to the interest of the general arrangement. Many people object to this mixed style of planting, charging it with lack of neatness, too much labour in tying plants to supports, lack of colour, bare earth, and general unsuitability for dressed grounds or formal beds. With the exception of the last, none of these objections are difficult to overcome. The last objection, in our opinion, is certainly a valid one, and therefore we should never think of adapting the style to such positions. Formality of design does demand—if we may be allowed the term—formality of plants, or, in other words, uniformity of height and a true balance of colour, without which a formal series of beds are anything but a pleasure to contemplate—at any rate, to persons of ordinary vision. As to the other objections, under the head of "arrangement," we hope to show how they can be surmounted.

Merits of the Style.—The principal one is that the great bulk of the plants being hardy and of easy culture, the smallest equally with the largest garden may have its mixed flower-bed or border. Another advantage is that, though desirable, it is not really necessary that there should be any set form of arrangement, so long as the plants are arranged according to height, and therefore the veriest novice need have no fear of failure, even on the score of arrangement. Another merit is that a *small* collection of plants looks just as complete as the largest, of course size of beds and borders being taken into account. Still another advantage is that there is but little labour attendant on the culture of the plants; tying, weeding, and clearing away dead

stems and flowers being all that is absolutely necessary after the plants are once in.

It will be seen that all these advantages are contingent on circumstances, such as size of garden, lack of labour, and inability to obtain a good selection of plants; the merits of mixed flower gardening being still greater where there are none of these hindrances, but instead thereof full scope to carry out the style in its entirety, which, to sum up in a few words, means effectiveness all the year round, as much flower as possible at all seasons, and distributed over the entire bed or border.

Situation.—To obtain such results, perhaps the most important consideration is situation and surroundings, for, though a bed of mixed plants may look well *as a bed* in any position, care should be exercised that the surroundings be in harmony with it; no geometry, statuary, or formal stone-work, and that no view, or graceful sweep of lawn, or boles of trees be intercepted by the planting. These avoided, almost any situation having a south or west aspect is appropriate; but by far the most effective places are shrubbery recesses on the lawn, and, next to these, wide borders of rainbow or horizontal form that are well backed up with shrubs. For there can be no question that, so far as regards effectiveness, the best arrangement is to have but one front to the border, for the reason that most of the tall herbaceous plants are unsightly at the bottom, and should therefore only be viewed *over* dwarfer kinds, and in front of a background of shrubs or other screen.

Soil and Culture.—If of moderate depth, any description of soil will grow the plants well, always provided that plenty of manure be given; but a deep loam of medium texture that does not need annual diggings-in of manure is a long way the best. Of course, all have not such a soil at command, and therefore recourse must be had to supplying the most suitable ingredients to the varying soils that have to be dealt with. A deep loam, if well trenched and given a moderate dressing of well-rotted manure, will need little, if any, other dressing for three or four years—a fact of the greatest importance, both as regards saving of labour and well-doing of plants, as many kinds of herbaceous plants attain their most perfect development when left undisturbed for years. Stiff, or what are called clayey loams, should be also deeply trenched, and plenty of light vegetable or leaf soil worked in during the process; this being another description of soil that, when well drained, the plants will flourish in for years, without any other dressing than that of an annual surface-mulching of manure.

For light soils, *deep* trenching is of the utmost importance, and with abundance of good manure the plants will do just as well as in the best loam, only every *second* year a fresh supply of manure is needed, a matter that involves lifting and re-arranging the plants: that is, if the best results are desired. In some respects, this biennial lifting is an advantage, for thereby an increased stock of plants can conveniently be had by division, and defects in previous arrangements of plants can be rectified. All other descriptions of soil will come under one or other of the three kinds here named, and should be treated as advised for these.

As to *general culture*, little is needed beyond a surface-dressing of manure in winter, and the keeping the ground free of weeds throughout the growing season, together with tying up such kinds as absolutely require support; but *only* such, for not a plant should be tied that is at all likely to be self-supporting; furthermore, the height of stakes ought never to exceed the height of the plants, and the ties should not be drawn so tightly that the plants present a lumpy, broom-like appearance. To some these points may appear matters of little moment, but they are of sufficient importance to make all the difference between attractive neatness and untidiness, and are therefore worthy of attention.

Arrangement of Plants.—Ever since increased interest has been taken in hardy flowering plants, and in mixed flower gardening generally, there has been more quibbling as to how *best* to arrange them than in anything else connected with flower gardening. Therefore it is not presumed that the arrangements here proposed will be accepted as perfect. But at any rate they have this merit, viz., that they have been put into practice, and satisfied those most nearly concerned. The old-fashioned "dot" system—that is, plants in single file, dispersed over the entire border with just as much precision as to height and distance from each other as might be expected in the severest geometrical pattern—cannot be too highly reprobated. Indeed, one wonders that the plan survived so long, and still more, that numbers yet continue to so arrange them; a circumstance that can only be accounted for by supposing that such persons have never seen, or even thought of, any other mode of arrangement.

What may be termed the *grouping style* is that we would advise, and which consists in planting a given number of plants in a mass, and in numbers proportionate to the spread and height of plants; the aim being to obtain colour in such quantity as to prove effective when seen from a distance. Dwarf-growing plants, such as the shrubby creeping Veronicas, Lithospermums, and the larger Saxifrages, may be in groups of twelve or eighteen

plants. Of course the groups should be of irregular form, and the numbers vary—say from eighteen to three, for the taller and more robust-growing kinds. Another important point to be observed is, that though it is imperative that the dwarfer kinds be confined to the front of the borders, a too strict line of uniformity of height should be scrupulously avoided, and pains should be taken to so dispose the plants as to *colour* that there shall be no violent or jarring contrasts; and further, season of flowering of the various species should be taken into account. The reason for the latter is obvious, viz., that there may be throughout the flowering season a regular dispersion of bloom over the entire border.

To carry out such an arrangement in its entirety, we well know, needs a better knowledge of this class of plants than even the majority of professional gardeners possess; but it is knowledge that is soon acquired, particularly if there is a natural fondness for the plants; and if there is not, there soon will be, if circumstances demand that mixed hardy flower gardening shall be of the highest order. Those in difficulty as to seasons of flowering, height, and spread of plants, and who have not a goodnatured neighbour capable of imparting the desired information, should procure the descriptive catalogues of our best hardy-plant nurserymen. We have personally tested such catalogues, and found them most reliable and wonderful aids in the arrangement of plants after this order.

There is one other merit in these mixed arrangements, viz., that any vacant plots there may be can, with a view to increased summer gaiety, be filled with tender or half-hardy flowering plants; indeed, it is a moot point as to whether vacant plots should not purposely be left with that intent; certainly our view is that there should. Of course, at other seasons the ground might be covered with hardy carpeting plants. Pelargoniums, Heliotropes, Fuchsias, Marguerites, single Dahlias, and Hollyhocks are a few of the many kinds of plants that can appropriately be used in association with hardy perennials.

Cut Flowers.—The arrangement of plants which are intended to afford cut flowers for decorative purposes should be much after the same order as regards grouping together; but, as in this case it is desirable to get at the flowers without treading on the beds or borders, these should not be more than six or seven feet wide, and may be arranged with the taller kinds in the middle; only *very tall* sorts ought not to be used, certainly none that exceed a yard in height; then the objection alluded to above, as to unsightly naked stems, will not apply. The borders of the kitchen garden are usually devoted to such purposes; at any rate, such arrangements ought not to occupy a site in the flower garden proper, as this latter should be held sacred to such flowers as are allowed to grow in their living beauty till they die a natural death.

The most perfect arrangement of hardy plants for cut-flower purposes that we have ever seen, was a narrow border each side of the central walk of a kitchen garden. At the back were horizontally trained espalier Pear-trees, the nearest row of flowering plants being thirty inches from the trees; thus neither the plants nor fruit-trees suffered by being in too close proximity to each other, and the fruit-trees formed a most appropriate background for the flowers. These situations, and arrangement of plants for cut-flower use, may serve as hints to those not having exactly similar places, towards selecting others that may serve the same purpose, with a view of preventing the *gathering of flowers from beds*, which it is desired to keep as gay as possible at all times.

Objections to this style of gardening comprise only two that are at all worthy of consideration; these being, *labour* anent the preservation of neatness and support of the plants by tying, and the difficulty of covering the ground. In respect of the first-named objection, we reply that no branch of gardening can be done well without labour, and that there is far *less* of it needed in this branch, even if tying and trimming up were carried to the utmost extreme, than there is connected with an ordinary bedded-out garden, if the labour of propagation, housing, pegging, and the like be taken into account, not to mention the short period that it continues in good condition. This really is the only logical way to look at the matter: and all who consider the question from this standpoint will, sooner or later, be ready to admit that the odds as to labour are decidedly in favour of hardy plants.

As to the difficulty there is in covering the ground, it is purely imaginary, as we shall hope to show by appending a list of plants suitable for carpeting the ground under and about every kind of plant used in the borders; but meanwhile, it must suffice to say that mossy Saxifrages and Sedums, and plants of allied nature, that are surface rooters only, and therefore do not rob the border of the nourishment that is required by the flowering plants, are every way suitable for carpets and undergrowths, and add in no small degree to the interest of the general arrangement.

There is another objection sometimes raised, which is, that the great bulk of hardy plants die down in winter, and then the borders look empty and are devoid of interest. Here again there is forgetfulness of what happens in every other depart-

ment of flower gardening, and that too with less prospect of a remedy than in this case, for which there are an immense variety of evergreen and variegated shrubs, that appropriately intermix with the flowering plants at any season, and during the winter season impart a furnished appearance to the borders. The names of the best kinds for this purpose will be found amongst the

List of Plants for Special Purposes.—First let us give a general list, including all sections of the best Herbaceous, Perennial, and Alpine plants:—

Acanthus mollis.
A. niger.
A. spinosus.
Achillea Ptarmica fl. pl.
A. tomentosa.
Aconitum Napellus.
Actæa spicata rubra.
Adonis vernalis.
Acantholimon glumaceum.
Agrostemma coronaria atrosanguinea.
Alstræmeria peruviana.
A. pulchella.
A. tricolor.
Anchusa italica.
Anemone alpina.
A. coronaria.
A. apennina alba.
A. japonica.
A. japonica alba.
A. nemorosa.
A. Pulsatilla.
A. fulgens.
Aquilegia californica.
A. chrysantha.
A. glandulosa.
A. thalictrifolia.
Armeria cephalotes rubra.
A. maritima alba.
A. plantaginea rosea.
A. grandiflora.
Alyssum montanum.
A. saxatile.
A. variegatum.
Asphodelus luteus.
A. luteus fl. pl.
Arundinaria falcata.
Arundo donax.
A. variegata and conspicua.
Aster altaicus.
A. Amellus.
A. bessarabicus.
A. coccineus.
A. ericoides.
A. perigrinus.
A. Townsendii.
Astilbe japonica.
Aubrietia Campbellii.
A. deltoidea grandiflora.
A. græca.
Bambusa aurea.
B. gracilis.
B. japonica.
Baptisia australis.
B. exaltata.
Betonica grandiflora.
Bocconia cordata.
Caltha palustris fl. pl.
Campanula celtidifolia.
C. grandis alba.
C. macrantha.
C. rhomboidea.
Cistus hirsutus.
C. florentinus.
C. lusitanicus.
Chrysocoma Linosyris.
Coreopsis lanceolata.
C. tenuifolia.
Cypredium Calceolus.
C. spectabile.
Delphinium cashmerianum.
D. chinensis.
D. nudicaule.
Dianthus arenarius.
D. capitatus.
D. fragrans.
D. neglectus.
Dictamnus Fraxinella.
D. Fraxinella alba.
Dodecatheon Jeffreyanum.
D. Meadea.
Dracocephalum Ruyschianum.
D. Ruyschianum japonicum.
Epimedium grandiflorum.
E. luteum grandiflorum.
E. macranthrum.
Funkia undulata.
F. ovata aurea variegata.
F. Sieboldii.
F. variegata.
Galega officinalis alba.
Galtonia candicans.
Gentiana acaulis.
G. asclepiadea.
Geranium armenum.
G. ibericum.
Geum coccineum plenum.
Gunnera scabra.
Helianthus angustifolius.
H. giganteus.
H. multiflorus plenus.
H. simplex.
H. majus.
Helleborus atrorubens.
H. colchicus.
H. niger.
H. altifolius.
Hemerocallis disticha fl. pl.
H. flava.
H. Thunbergi.
Heuchera sanguinea.
Hypericum balearicum.
H. calycinum.
H. nummularium.
Iberis gibraltarica.
I. Garrexiana.
Iris Kæmpferi.
I. orientalis.
I. stylosa.
I. Susiana.
Kniphofia aloides.
K. macowani.
Lathyrus biflorus.
L. latifolius.
Linum flavum.
L. candidissimum.
L. perenne.
L. perenne album.
Lithospermum prostratum.
L. polyphyllus.
L. polyphyllus albus.
Lychnis chalcedonica fl. pl.
L. chalcedonica alba fl. pl.
L. dioica rubra fl. pl.
L. d. alba fl. pl.
L. Viscaria alba.
L. V. plena.
Lysimachia clethroides.
Malva moschata.
Matricaria inodorum fl. pl.
Monarda didyma.
Nierembergia rivularis.
Œnothera Frazeri.
Œ. macrocarpa.
Orchis, any hardy species.
Pæonia (many varieties).
Papaver nudicaule.
P. orientale.
Pentstemon barbatus.
P. heterophyllus.
Phlox Nelsoni.
P. frondosa.
P. subulata.
P. verna (and many others).
Polemonium cæruleum variegatum.
Polygonum cuspidatum.
P. giganteum.
Potentilla ambigua.
P. atropurpurea.
P. cæspitosa.
P. hybrida plena.
P. splendens.
Primula acaulis grandiflora.
P. cashmeriana.
P. cortusoides.
P. denticulata.
P. farinosa.
P. intermedia.
P. rosea.
Pyrethrum uliginosum (and many hybrid varieties).
Ranunculus amplexicaulis.
R. anemonoides.
R. speciosus.
Rudbeckia speciosa.
R. fulgida.
R. subtomentosa.
Saponaria ocymoides.
Saxifragas (in great variety).
Schizostyllis coccinea.
Sedums (in great variety).
Selaginella helvetica.
Sempervivum (in great variety).
Senecio pulcher.
Silene alpestris.
S. maritima fl. pl.
Solidago Virgaurea nana.
Spiræa Aruncus.
S. Filipendula fl. pl.
S. palmata.
S. venusta.
Statice incana.
S. latifolia.
Trillium grandiflorum.
Tropæolum polyphyllum.
T. speciosum.
Veratrum album.
V. nigrum.
Veronica amethystina.
V. candida.
V. longifolia subsessilis.
V. Lyallii.
V. orientalis.
V. Traversii.

The following is a list of hardy plants which are suitable for planting as *undergrowths* to tall-growing kinds, particularly beneath such as die down in winter, to secure that the borders may present a furnished appearance at all seasons:—

Alyssum maritimum.
A. montanum.
Antennaria tomentosa.
Arabis albida variegata.
Arenaria balearica.
A. montana.
Artemisia frigida.
Aubrietia Campbellii.
A. Campbellii variegata.
Cerastium tomentosum.
Genista prostrata.
Helianthum canum.
H. roseum.
Lamium maculatum album.
Leptinella scariosa.
Lithospermum prostratum.
Lotus corniculatus.
Lysimachia nummularia.
Mentha Requieni.
Phlox procumbens.
P. reptans.
Potentilla reptans.
P. verna.
Pyrethrum Tchiatchewii.
Santolina alpina.
Saxifragas (many varieties).
Sedum (many varieties).
Silene acaulis.
S. alpestris.
Thymus Serpyllum varie gatus.
T. lanuginosus.
Veronica alpestris.
V. repens.

Next we require such as the following list of *evergreen shrubs* and other plants which harmonise well with herbaceous plants, and which may be used *sparingly* over the entire border, with a view to winter effect:—

Cupressus Lawsoniana erecta viridis.
C. L. nana.
Daboecia polifolia alba.
D. polifolia atropurpurea.
Daphne Cneorum.
Euonymus japonicus variegatus.
E. japonicus argentea aurea.
E. japonicus radicans variegata.
Erica herbacea.
E. carnea.
Juniperus hibernica.
J. hibernica compressa.
Kalmia latifolia.

K. latifolia myrtifolia.
L. latifolium.
Pernettya mucronata.
Retinospora ericoides.
R. obtusa.
R. filifera.
R. argentea.
R. plumosa.
R. aurea.
Skimmia japonica.
Thuja aurea.
Veronica Traversii.

The following is a list of plants which are suitable for *edgings* to hardy plants, borders, and beds:—

Achillea ægyptica.
A. tomentosa.
Ajuga reptans variegata.
Alyssum saxatile variegatum.
Antennaria dioica.
A. tomentosa.
Arabis albida variegata.
A. lucida variegata.
Arenaria balearica.
A. montana.
Campanula cæspitosa.
C. carpatica.
C. alba.
Cerastium alpinum.
C. Biebersteini.
C. tomentosum.
Coronilla montana.
Dactylis glomerata variegata.
Festuca glauca.
Funkia subcordata.
F. ovata variegata.
F. Sieboldii variegata.
Gentiana acaulis.
G. verna.
Hypericum nummularium.
Lamium maculatum album.
Lithospermum prostratum.
Lysimachia Nummularia.
L. N. aurea.
Phlox reptans.
P. subulata.
P. alba.
Santolina incana.
Saponaria ocymoides.
Saxifraga hirta.
S. rosularis (and many others).
Sedum acre elegans.
S. corsicum.
S. glaucum.
S. Lydium (and many others).
Thymus citriodorus.
T. aureus.
T. languinosus.
T. Serpyllum alba.
Veronica alpina.
V. candida.
V. rupestris.

Many other kinds of plants might be mentioned that would perhaps do equally well for the purposes named as those given; but the lists are ample for all practical purposes. As to variety of summer bedding plants which are suitable for herbaceous borders, we would simply say, any kinds and any quantity that are to spare, so long as the general arrangement is not marred by placing them in uniform order over the border.

ANNUALS AND BIENNIALS.

Annuals are usually divided into three groups or sections, viz., hardy, half-hardy, and tender. The latter group, being only suitable for greenhouse culture, does not come within the scope of these papers

The Hardy section are those that withstand the winter in the open ground, and are mainly used for the decoration of the flower-beds in early spring, and for intermixing with herbaceous perennials in the hardy plant-borders. The half-hardy section are mainly used in conjunction with summer bedding plants, for which nearly all of them are well adapted. Both the sections contain many kinds of plants that are infinitely superior for flower garden purposes to many kinds of bedding plants, and one can only attribute their neglect of culture to the fact that people do not properly estimate their value, or try to do them justice by giving them a similar amount of attention that ordinary flower-garden plants receive. Granted that their season of flowering is of short duration, yet when desirable it can, with foresight as to successional sowing, thinning, and pinching, be prolonged throughout spring, summer, and autumn. Such prolongation of flowering hinges principally on

The Time to Sow.—Hardy kinds that are intended to flower in April and May should be sown in September, successional sowings being made under hand-lights in January and February, and again in April, May, and June, these last three sowings, as also those in September, being made in the open ground. For the September sowing, select a warm sunny border, dress with vegetable mould or well-rotted horse-droppings, and dig deeply; then draw shallow drills a foot apart, sow thinly, and cover in the seed by hand. Soon as up, thin out the plants an inch or two apart, such early thinning being an important point in the seedlings growing up sturdily, as also for transplanting to their flowering positions without serious check from the roots having got matted together with other plants. Soon as large enough for transplantation, they may be done at any time, or be left thinly in the seed-bed till February. The successional sowings advised to be made in January and February should either be under the protection of a frame or hand-light; in other respects they may be treated as those sown in autumn. Spring and summer sowings may either be sown in exactly the same way, or, where they are to flower; this latter is a plan not to be commended, unless ample time can be afforded to look after slugs, which are most destructive to annuals till they get an inch or two high, when their attacks cease, either through the plants being distasteful or too tough.

Persons who have practised this most general way of raising annual flower-seeds, and failed oftener than succeeded, would do well to give up the practice, and raise the plants either in frames or on a warm border, and when transplanting give them good space. They may then expect to be rewarded by large robust plants that will not only keep in a flowering state for a longer period, but the flowers will be very much finer. If, however, there is not convenience for sowing in other places than where the plants are to flower, early thinning should be insisted on, and the first flowers and points of shoots be pinched off to induce the plants to branch; and tall kinds that need stakes should be tied before they get out of the perpendicular or get injured by wind or heavy rains.

The list of hardy kinds is a large one, but there are numbers of but little service other than from a botanical point of view. Obviously, therefore, for flower-garden purposes these are of no

value; hence only those kinds that last longest, are easily grown, and are the most showy, can have a place in this

List of Hardy Annuals.

Alyssum maritimum.
Bartonia aurea.
Calliopsis atrosanguinea.
C. coronata.
Candytufts (various).
Clarkia elegans.
C. elegans rosea, fl. pl.
C. integripetala.
C. integripetala alba.
C. pulchella.
Collinsia alba.
C. bicolor.
C. grandiflora.
Convolvulus minor (dark blue).
Eschscholtzia californica.
E. flore-pleno.
Gilia tricolor.
G. tricolor rosea splendens.
Godetia, Lady Albemarle.
G. Duchess of Albany.
G. rubicunda.
Larkspurs (various).
Limnanthus Douglasi.
L. grandiflora.
Linaria bipartita splendida.
Lupins (various).
Linum grandiflorum coccineum.
Mignonette.
Nasturtiums (various).
Nemophila atomaria.
N. insignis.
N. maculata.
Sweet Peas (various).
Sweet Rockets.
Sanvitalia procumbens.
S. flore-pleno.
Saponaria calabrica.
Scabious (dwarf double).
S. sweet.
Schizanthus grandiflorus oculatus.
S. pinnatus.
Silene pendula.
S. pendula compacta.
S. pendula ruberrima.
S. pendula (double).
Sweet Sultan (purple).
S. Sultan (white).
S. Sultan (yellow).
Virginian Stock (red).
V. white.
Whitlavia grandiflora.

Half-hardy kinds are indispensable for summer display, and, being more *generally* grown than the preceding, their culture is better understood. All the kinds require the shelter of a frame or hand-light to raise them successfully, and most of them a slight hot-bed, such as that which is derived from a bed made of two-thirds leaves to one of stable-litter. The soil should be light and fine, and the seeds be covered very thinly in rows six inches apart. The finer seeds, such as Amaranthus, are best sown in pots and pans and plunged in the bottom-heat. The lights or frames should be kept closed till the seeds have germinated, when air should be given freely, and gradually increased till the plants can be fully exposed. Thin out when about an inch high, planting the seedlings in some sunny spot, to be protected at night with netting or mats, or, if cold frames are available, prick them out in these. *Stocks*, and others that make lengthy tap-roots, are the better if pricked out on soil resting on a hard bottom, to prevent the roots descending, as they then make side-rootlets that transplant with *soil attached*—a very necessary condition, for Stocks especially, which are proverbially bad plants to move. Time of sowing must to some extent be dependent on the time they are required to flower; if early, sow in March and successionally to the middle of May, then a succession of flower will be secured from June to October.

List of kinds.—The following are the best and most generally useful of this section:—

Half-Hardy Annuals.

Acroclinium roseum.
A. album.
Amaranthus bicolor.
A. melancholicus ruber.
Asters (various).
Balsams.
Bartonia aurea.
Brachycome iberidifolia.
Downingia elegans.
D. pulchella.
Gaillardia hybrida grandiflora.
Gourds.
Helichrysum (various).
Ice Plant.
African Marigolds.
French Marigolds.
Matricaria nana aurea crispa.
Nicotiana affinis.
Palava flexuosa.
Phlox Drummondii (various).
Portulacas (various).
Salpiglossis.
Stock, German.
S., Ten-week.
S., Intermediate.
S., East Lothian.
Tagetes signata pumila.
Tropœolum canariense.
Tropaeolum Lobbianum.
Zinnia elegans.

Biennials.—These, as the word implies, do not flower the first year of sowing; but this constitutes almost the whole of the difference in their culture and that of Annuals. All the kinds are hardy; at least hardy enough to withstand our ordinary winters. Brompton Stocks, Wallflowers, and Rockets sometimes succumb; but a little protection, in the shape of leaves or litter, when the weather is exceptionally severe, will save them.

For most districts, the best time to sow the whole of the kinds is about midsummer. Select a well-drained border, with a sunny exposure, but sheltered from east and north winds. Prepare the soil by digging deeply and applying a dressing of leaf-mould; then draw drills six to nine inches asunder, sow, and cover with soil to a depth of half-an-inch, and the operation is complete. As soon as the plants are large enough to be thinned out, the surplus should be afforded the same favourable position as the seed-bed. The time to permanently transplant varies from September to February; for, though they may do well transplanted in autumn when the plants are thus isolated, there is a risk of their being destroyed by vermin or frost; hence we prefer to leave them together till February when, if needs be, they can be protected.

List.—The following are the most generally useful kinds:—

Anchusa italica.
Canterbury Bells.
Catananche bicolor.
C. cœrulea.
Foxgloves.
French Honeysuckle, red and white.
Honesty.
Indian Pinks.
Pentstemons.
Sweet Rockets.
Sweet Scabious.
Brompton Stock.
Sweet Williams.
Wallflowers.

Where to Plant and How to Arrange.—Having enumerated all the kinds that we have proved effective in various positions, it only remains to indicate such positions, of course premising that the soil is of a lightish nature, deeply dug and well manured. The most appropriate place for most of the kinds are the hardy herbaceous borders, where they should be planted in clumps of from three to

nine plants in each, according to the size, height, and spread of plants, the dwarfer growers being near the front and the taller behind, and disposed as to colour after the strictest contrasting rule, that is, scarlet, yellow, blue, white, and so on. Harmony of colouring is an utter impossibility in mixed borders, and we have long since given up the attempt to attain it. Dwarf annuals, such as Virginian Stocks, Mignonette, and Saponaria calabrica are excellent for filling out the front parts of such borders, and do first-rate sown where they are to flower. Stocks, Asters, Phlox Drummondii, Zinnias, and Everlastings make excellent beds in themselves, and they also look wonderfully well planted in straight lines in long borders as follows: a back line of Sweet Peas, then Everlastings, next Lupins, next Zinnias, next tall Asters, then Stocks and Phlox Drummondii alternated, the Phlox forming a cushion for the Stocks and dwarf Asters that are planted as a marginal or front row.

There are some few that make excellent bedding plants, and may be requisitioned for that purpose when ordinary bedders are likely to run short. These are Brachycome iberidifolia, Sanvitalia procumbens, Nemophilia insignis, the Annual Chrysanthemums, Portulacas, Collinsia bicolor, Phlox Drummondii, Clintonia pulchella, and the African and French Marigolds. Probably there are no other flower-garden plants that receive so little cultural attention as do the major portion of Annuals, and a word of advice on this score is therefore necessary; and that is, give them their due proportion of care as to soil, thinning, tying, staking, mulching, and vigilance anent the attacks of grubs and slugs, and they will reward such attention by proving—all points considered—at least equal, both in length of season and quality, to any other garden flowers.

THE CUCUMBER.

By William Earley.

Cucumber (*Cucumis sativus*). French, *Concombre;* German, *Gurke;* Spanish, *Cohombro.*—The culture of the Cucumber has interested amateur and practical growers greatly from the earliest period of its introduction down to and including the present time. With the generality of cultivators, frame culture is practised, owing to the fact that glass structures are generally expensive to erect and maintain. For market purposes, and where the consumption is large, the latter is, however, to be preferred, if not essential.

Though a native of the East Indies, the several sub-varieties obtained by cross-fertilisation, &c., down to the Gherkin, a short prickly form grown in the open fields, will thrive more or less in a lower degree of warmth than is generally surmised. Even "frame" Cucumbers will succeed in green-houses during the summer months, as will certain kinds of moderate length and quality upon ridges out of doors, having the assistance of a little bottom heat and hand-lights only, to give them an early and free start into growth.

Though, however, it is comparatively easy to grow Cucumbers during the summer months, or from the month of May to September, inclusive, much care and attention is requisite to succeed with them throughout the winter months and in the very early spring. At these seasons an insufficiency of light and an excess of moisture are the chief evils to be guarded against. Winter Cucumbers have now, however, become so much a necessity to many growers, that special instructions will be given for their culture; but as the frame culture of the Cucumber is really within reach of all, we will give full instructions in regard to them first.

The Preparation of the Materials and Sowing of the Seeds.—To secure a good early crop of fruit, the necessary materials should be got together towards the end of the month of January in each year. Owing to the small amount of space actually needed to raise seedlings in, a one-light frame will be amply large enough. The fermenting materials for this frame must be thoroughly sweetened by the process of successional fermentations, by repeated turnings over, so that no rank steam can possibly be given off from them subsequently. The bed for this one-light must be five feet high when first packed up, and exceed the length and width of the frame by four inches on all sides. Linings must next be packed against this bed all round, some eighteen inches to two feet in width, and be so brought up at the top as to cover the outer woodwork of the frame on all sides. Such heat as thus penetrates through the woodwork of the frame will have a needful drying effect on the atmosphere within: as, given the needful amount of artificial warmth, the greatest difficulty subsequently will be to keep down excessive steam, or atmospheric moisture. By making up this bed, with linings, early in the month of February, letting it heat well with the sash on, but with air given freely back and front, the heat will be so moderated early in the same month also, that seeds may be sown in pots and placed therein. Hence, by the time the young plants are through the ground, a warm pure atmosphere will exist, which by air-giving, &c., should be a mean of about 78° or 80° by day, and not less than 74° by night. A layer of hay, over which mats may be placed, will insure the necessary degree of warmth by night, though a very

small aperture to give egress to excessive internal moisture or steam must be given at the highest part of the frame at the back.

The seeds should be sown three or four each in two or more 60-sized pots, wherein ample drainage must be first placed, then a layer of moss, and filled with a finely-sifted loamy soil and leaf-mould in equal quantities. Press the soil somewhat firmly, and do not water it until it becomes moderately dry after the seeds have been sown a day or two. If too much moisture be permitted them at first, they are liable to decay ere germination is completed. So soon as the young plants have pushed through the ground, and show the third, or first rough leaf, pot them off into other similar pots and soil, placing two at two opposite sides in each pot. By permitting the young plants to touch the sides of the pots, they are less likely to decay than when placed centrally in mid-soil, for they are tender at this season of the year, and very liable to injury from steam, &c.

Meanwhile, and while these operations are proceeding to raise young plants and grow them into planting-out size, a larger heap of stable dung only, or a half-and-half of stable dung and tree-leaves, should be preparing, and being worked into what is called by gardeners a sweet state; that is, all the rank steam and burning heat should be got out of it. As this is of vital importance we will, at the risk of some repetition, repeat the processes taken to insure a sweet and durable warmth in what is called the bed.

As, in process of fermentation, rank steam is given off, the manure must be first purified and subdued by the simple means of throwing the whole of the materials up together into a conical heap. So soon as they become warm throughout and give off steam freely, they must be again turned over. Commence at one side of the heap, removing the outer sides; make a base for the heap of the outsides, and so turn all over into the new heap, keeping the existing centre on the outer side, and the sides in the middle. Shake every forkful well, so as to separate the materials, building it up in conical or ridge form. This should be done three or more times at the least; after which measure out a space upon a warm sheltered aspect facing the south, similar in shape to the frame which is to be used, but from four inches to a foot wider and longer than the actual size of the frame. Build thereon a square bed, which should be three or four feet high at the back, and one foot less in height at the front. When it is built, having been trodden down in process so as to make the materials moderately firm, put the frame upon it facing south, covering it over with the sashes. Then place a lining of the same materials up against the bed, about fourteen to sixteen inches wide all around, fashioning it nearly similarly to the bed. Permit all to remain thus with the sashes shut down close until the inside of the frame is full of steam; then open it, lightly fork up the inside of the bed, and replace the sashes, giving a little air at the back only. Now place more material upon the outer lining, bringing it up to within half a foot of the top of the frame all around. Later on in the season the lining may be dispensed with—at least, until the heat within the bed subsides, when it may be added to give an additional fillip to the declining warmth within the frame.

Every precaution must be taken to build the bed upon the most sunny site possible, especially at so early a period of the year when so little sunshine exists. It must also occupy a space that is not liable to the inroad of superficial storm-water. In low-lying gardens, and where any doubt exists in this respect, it is desirable to first lay upon the ground-surface a base for the bed, consisting of old wooden blocks or faggots, arranged in neat shape and the exact size of the bed. A thick layer of straw, even where the latter is not needful, will besides always prove an advantage, even upon sites that are somewhat elevated and habitually dry.

Well elevate the frame at the back, in such manner as to insure that all probable sunshine shall pervade as far as possible every part within.

When the heat within the frame falls to a mean of about 90°, place another layer of material all around the insides of the frame, tread it down somewhat firmly in such a manner as to fix it tightly against the sides of the frame, and underneath its lower edges, if possible, in view of keeping out any steam, which might otherwise rush in that way from the outer linings.

The next process is to put a mound of suitable soil under the centre of each sash.

Should there be any doubt as to the regularity of the heat within the bed, and any possibility that it may exceed the mean given as a safeguard, a good square turf from pasture-land might be placed over the surface of the bed first, upon which the mound of suitable soil might be put.

Planting Out.—The best soil for Cucumbers is one consisting of decayed pasture turfs two parts, well broken up; one part fine, slightly stiff, yellow loam, and one part thoroughly rotted leaf-mould and stable manure, all well intermixed. Place this mound of compost lightly in conical form up to within six inches of the glass, and await a day or two for all to become warmed through. At which time, should the internal heat not exceed 85°, the plants may be planted.

Plants fit for planting out should have two or three rough leaves, or such as follow the two original seed-lobes. They should have just the point of the young shoot pinched out beyond the second rough leaf, and if permitted to form lateral shoots, however undefined subsequently, so much the better. Precisely similar treatment of the seeds will suit house culture, &c. Turn the plant out of the pot carefully, remove the crock at the bottom of the mould, make a deep hole in the centre of the mound, and place the plant therein, drawing the soil up around the roots, pressing it somewhat firmly; then bury the stem of the plant up to within an inch or two of the lower leaves. Shade, if the season is so advanced as to need it, for a day or two; give air in moderation when the weather is fine. Insert a thin wedge under the back of the sash during the night, allowing a space of about a quarter of an inch only for egress of all excess of steam, and cover the sashes over with hay or straw, kept in place by means of a mat over all, so as to insure a night temperature of 70°. Take care to remove this covering at the approach of daylight, that no light be lost. With fine weather, symptoms of growth in the plant, not too much steam, and a knowledge that the mound of soil does not contain an excess of latent moisture, give to the roots of the plant a little tepid water about the eighth day after planting.

The internal heat must in future be "kept up" by renovating the linings around the outer sides. One portion only should be renovated at a time—say the front lining, a side one, or the back. A store of material must be kept for this purpose, and the operation must be done as quickly as possible, choosing the early part of a fine day upon which to do it. The existing lining simply requires to be turned over, adding a little fresh material throughout in process of turning. Should any portion of the old lining have become dry in process of fermentation, damp it with a rosed water-pot.

In a few weeks the plants will be making progress. As a result, sundry roots will protrude through the mound of soil. Place another layer of prepared compost over all, and well up around the collar of each plant. At the same time lighten up the material around the outer sides of the mounds of soil to aid heat in ascending. This process of moulding up must be repeated as needed, until finally the whole internal surface of the bed, from plant to woodwork of the frame, is one mass of such. Plant-growth will have now advanced; sunlight and the outer temperature will have greatly increased; waterings will have to be more frequent, good root-soakings being required once a week; and daily between 3 and 4 o'clock p.m. the whole internal surfaces—plants, bed, frame-sides, &c.—should be sprinkled over and shut up so closely that air cannot gain ingress. By this means the internal heat may rise to 90°, 95°, or even 100°. Again give a little air at the back about 6 p.m. Increase it so soon as the influence of the sun is felt within next morning, still increasing it as the morning wears into mid-day, in such manner that the internal heat be maintained at 85° for the maximum, but do not let it fall below 68° as a minimum.

Culture in Glass-houses.—The culture of the Cucumber in glass-houses, whether in summer or in winter, is more simple and easy, and involves less trouble than their culture in frames. Cucumber-houses should always be abundantly heated, the hot-water pipes being in excess of any demand likely to be made on them. Tanks used to be a favourite means of furnishing bottom and also affording surface heat. These answer well when covered over so that a dry or a moist heat may be commanded at will. In growing winter Cucumbers a dryish atmosphere is necessary, and shorter varieties are mostly grown at that season, such as Sion House, Telegraph, and Monroe's Duke of Edinburgh. Bottom heat is also essential to winter, and as beneficial to general house culture as for frames. Indeed, for winter culture it is most important that an unfluctuating bottom heat of about 80° be maintained. This is best secured by the means of hot-water pipes running through a space beneath the beds of soil wherein the plants have their roots. Flues properly heated will suffice, but the above are best. Neither must be in immediate contact with the soil, however, but should occupy a chamber beneath it. A convenient method is to have iron or wooden framework elevated about six inches above the pipes or flue, upon which rough materials are first placed, and subsequently the soil. The mound of soil in this latter instance must be deeper, and it may be richer than such as is used for framework. Unlike the latter, it has not a base of manure below wherein the roots extend and feed eventually. If, therefore, it be not of good depth or bulk, it will eventually, when the roots are filling the soil-space, not afford permanency of food-supply for advancement. In placing the soil in the side pits press it down somewhat firmly, but place a conical mound up from it near to the glass, lightly, whereon and wherein to plant the young plants out. By these means more and more soil can be added, as the roots are seen to permeate it and to extend through it.

The advantages attached to house culture, especially during adverse seasons of the year, consist of the fact that a damp base with its steam emanation, and with no power of drying excess of moisture excepting with sunshine, as with frame culture, does not exist. Hence root waterings and surface sprink-

lings, and their subsequent drying by artificial heat, so highly refreshing, are accorded, and to their lasting benefit.

The drying tendency which the pipes have in the sunken chamber below the roots must not, however, be overlooked, and root waterings of a free and copious nature must be given periodically to insure that proper moisture exists. In connection with these a little additional heat may always be given advantageously. Nor should the fact be overlooked that over-head syringings at proper seasons may also be far more copious. Indeed, they must be, as a counter-tendency to the dryness of the artificially-heated atmosphere.

When Cucumber plants grow and fruit freely, periodical attention is requisite in regard to pruning and stopping. So soon as the shoots start strongly into growth, in whatever position, pinch off their points: the result will be that sundry young lateral or side shoots will form. It is at the axils of the first or second leaf upon these laterals that the female flower, or fruit-bearer, will be formed. Early in the season it is an old practice to procure a matured male flower; remove the outer petals when dry, and insert it just within the fully-expanded female flower, the latter being always conspicuous by having the miniature Cucumber form for a foot-stalk. The practice is, however, seldom now adopted, unless in the culture of sorts for seeds.

So soon as the young Cucumbers are seen upon the lateral shoots, pinch off their points also at one leaf beyond them. Eventually, whether frame or house-grown, the plants will have grown so freely as to require periodically thinning out. All old leaves should be removed so soon as they show symptoms of decaying, unless a fruit be at the axil of any, when it is not desirable to do so—bearing this fact in mind also at such times as leaves become too numerous and densely grown together, when thinning them out will be often necessary. Remove at such time any aged long portions of the vines having no fruits attached, and try to induce relays of young shoots from as near to the base of the plants as possible. When plants have been in bearing some time, and immediately after such a pruning, it will be a great aid to them to give the soil within the frame a thin mulching with rich compost. An occasional top-dressing with dung or some of the many artificial manures, with a good manurial watering, will also prove advantageous. These are especially useful to such structures as are kept rather too dry for Cucumbers, for the sake of other plants.

A very important consideration connected with the bearing plants, and one not generally attended to as it should be, is that of removing from the plants all young Cucumbers so soon as they attain to full size. To permit them to remain upon the vines after this stage has been reached is to doubly tax the plants, whilst the quality of the produce is also materially lowered. The fruits keep admirably in water, especially if a small portion of the stalk end be removed occasionally.

The insects which infest Cucumbers comprise red spider, thrips, and aphis. Insufficiency of moisture often gives birth to the two former. Every endeavour should be made to resuscitate health in view of throwing them off; dusting with flowers of sulphur for the former, and fumigating for the two last, being efficacious.

Mildew, a parasitical growth, sometimes infests the leaf surface during the winter months even in structures heated by artificial means, and occurs at times in connection with frame culture during cloudy weather in summer. An excess of atmospheric moisture, with too little warmth, is the cause, and simply but slightly dusting all infected parts over with flowers of sulphur the remedy.

Culture of the Cucumber in the Open Air.—Outdoor or field culture is somewhat extensively followed by market-garden farmers, being the practice followed to produce the masses of inferior produce, Gherkins, &c., which are so prominent a feature in autumnal town markets.

The plan employed is to deeply and well work and manure the ground. Subsequently, very early in the year, single but thick rows of rye are sown across the space whereon field Cucumbers are to be grown, at distances of about twelve feet apart. These eventually grow up so as to screen the young plants from the cold, being sown as a rule from north to southward. About the first week in the month of May the soil is again freshly worked up, and during fine weather the seeds are sown in about three rows, at about six or eight inches asunder in the rows, between each two rows of rye. When the young plants push through the ground they are carefully hoed amongst, similar attention being given as required throughout the summer; the only other attention they require being the leading of main shoots into vacant spaces around, and removing the fruit when of proper size.

Ridge Cucumbers consist of intermediate forms, obtained by intercrossing tender frame varieties and the hardy form of Gherkin. They comprise a class which can be cultivated by all who do not possess glass structures, pits, or frames.

The ridge, or mound, is formed by first placing fermenting materials enough together in a long narrow heap so as to give a moderate quantity of heat; the most convenient and best plan being to take out a portion of the soil in any given space

from eight to twelve inches in depth, and from three to four feet in width. The length not to be less than four feet, and as much more as can be made up with existing materials and extent of crop required. When the soil is being taken out from the trench, lay it in equal quantities on both sides, and place the fermenting materials therein, to a depth of about three feet. These materials may consist of all kinds of garden clippings, sweepings, and gleanings collected together in process of cleaning up, even to hedge and ditch clippings, &c., and the green grass collected in process of lawn-mowing, &c. Mix all up together well. Make the top somewhat flat, and cover the sides over, with the soil previously taken from the trench. Place a long stick in the centre of the mound, and when it is perceived, by drawing this stick out and feeling it, that the materials are heating, in process of fermentation, procure good rich, fibrous, yellow loam, add to it about one-third of rotten manure, mixing both together, and place a ridge of it along the top of this mound. Either sow seeds at once along the apex of this ridge, or, having procured plants, plant them along the centre of the mound, at equal distances of about twelve or fifteen inches apart. It is an excellent aid, in both cases, to place hand-lights or bell-glasses over them for a few weeks, giving a moderate quantity of air to the plants so soon as they exist beneath.

To ascertain whether the heat is likely to be in excess of what may be actually required, as occasionally during the first two or three weeks it may be, test-sticks must still be maintained within it, which should be withdrawn and felt occasionally. If at any time they become very warm, make holes in the mounds with a large stake, leaving them open when made, in such manner that the excess of heat can rush out through them. By these means, injury therefrom to the young growing roots is not likely to occur. Growers who cannot tell from moderate experience how warm mounds are by this simple means, may make a similar hole, about the centre of the mound, insert therein a thermometer, cover it over, and ascertain in a few hours subsequently what amount of warmth it registers. Should this exceed 100°, it will be necessary to subdue it by means of the holes as suggested. When it does not exceed this, the internal heat is not likely to become too great.

When seeds are sown in the ridge, the young plants will, so soon as they have formed three or four rough leaves, need "stopping," that is, pinching out the points just beyond the third or fourth rough leaf. This will induce them to "branch out," or form duplicate young shoots, in lieu of the one only existing previously.

As growth advances, give more and more air to hand-lights, or bell-glasses, until these are becoming moderately filled with the growths, then elevate them upon bricks, in such manner as to permit the young shoots to grow out under and beyond them, pegging them down in place as they extend. At this juncture give root waterings. When growth is seen to be free and to have extended beyond these sheltering hand-lights, remove them bodily, choosing a fine warm period for the purpose, and during the afternoon of any chosen day. Should the sunshine be very powerful on the following days, place a few tree-branches for shade over such parts of each plant as previously grew under hand-lights, to secure them from injury thereby. During all subsequent dry weather periods give root waterings, as may be deemed expedient, so as to insure a free and constant supply of moisture. Occasionally pinch back any strong growths, needful to insure fruiting laterals, and pinch back the point of each lateral at one leaf, beyond where all female flowers are seen to exist. As the plants progress in growth, add a little fresh soil and manure in equal parts to the surface of the ridge, in such manner that an occasional joint, or the axil of a leaf upon a matured branch, be buried therein. By this means roots will be induced to form thereon, to the general benefit of each plant, and its fruit-bearing capacity. Syringe the leaves over morning and evening during dry arid weather, after once they are well established, taking care to search among the leaves, &c., often, to ascertain what fruits exist, in view of removing them at the earliest moment possible, when of sufficient size; to permit them to remain upon the plants one day beyond, is to unduly tax the latter, to the deprivation of future fruits and permanent health.

The best varieties, of which many exist, are:—Abbott's Prolific, Cuthill's Black Spine, Dreadnought, Carter's Model, Telegraph (Rollinson's), and Tender and True. For outdoor ridge-work, Improved Stockwood Long Ridge, Incomparable Ridge, and Long Prickly.

CUCUMBER-GROWING BY EXPRESS.

By D. T. Fish.

This is the latest and newest departure in the culture of the Cucumber; and as it is the speediest, it is also likely to become the most popular and profitable mode of production. Hence, it is needful to describe it in a work of this kind by one who has reduced it to successful practice. In brief, as the title implies, it is a fast mode of production. This, of itself, is a high recommendation, for the quality of Cucumbers, like that of Lettuces, is largely dependent on the rate of growth. The faster in reason they can cover the space between the start and the finish, the sweeter, more crisp, and tender

the produce. Any check to growth develops toughness or bitterness in the produce. Besides, these annual plants have no intrinsic value in themselves, such as choice Heaths, Rhododendrons, or other stove or greenhouse plants; Cucumbers are grown simply and only for a certain amount of produce. That of first-rate quality, in the shortest time, is therefore all that the cultivator has to trouble about: the Lettuce being well hearted up and cut, the stump is relegated to the rubbish-heap; and so in a measure with Cucumber plants. After yielding a dozen, fifty, or a hundred fruits, the plants are useless, and can be cleared away to make room for others. Should the plants even break down under express culture after a dozen or a score of crops, the quick returns, as heavy in quantity as superb in quality, would still be in favour of express culture; but unless cropped to excess or otherwise mismanaged, the plants do not break down. On the contrary, the faster they grow and the heavier the crop of fruits they set and swell, the more vigorous the plants grow. The plants throw off produce as an athlete muscular vigour, gaining more strength with each display of agility or force.

Nor is the secret of the apparently inexhaustible supply of vital and productive force far to seek. Three conditions are needful to insure success in the express mode of growing Cucumbers. These are light, heat, and moisture. The first is the source of strength; the second, the cause of motion; the third, the means of keeping the plant fully supplied with all it needs. Experienced cultivators, as well as novices, will observe that one thing that is mostly made so much of by cultivators is conspicuous by its absence, that is, air. Cucumber-growers by express look upon air with suspicion. As mostly applied, it wastes time as well as heat and moisture, hinders growth, and puts a drag on the wheels of rapid production. Hence, they simply ignore it. No doubt air will reach Cucumbers or other plants without our aid, and in spite of our attempts to hinder it. But that is quite a different matter to the building and warming of Cucumber-houses, and taking means to semi-saturate the air of the same by artificial means, and then sweeping out all these aids to growth by the in-rush of the external air through open ventilators. This is a folly that the express Cucumber-grower declines to be guilty of.

Fully exposed to the light, Cucumber plants will bear a temperature of 120° with impunity. With the atmosphere at saturation the fruit and plants will grow like weeds in a temperature ranging from 90° to 120°. The expression must not be understood to mean that the plants will become weedy: quite the contrary. Fully exposed to the light in a semi-saturated atmosphere, with the roots fully fed with solid or liquid manure, the plants continue in the most robust vigour, under these forcing conditions. The leaves are full of vigour, verdure, and substance; the soil filled with a perfect network of roots, overflowing the root-runs into the moist air so rapidly as to need top-dressing to cover them at least once a week or ten days. This incessant top-dressing with solid compost, and root-feeding with sewage or manure water, is one of the secrets of success in the express culture of the Cucumber. Hence, the importance of a thoroughly drained basis and a porous bottom of rough, turfy loam, to make sure of the rapid escape of water, and prevent the possibility of stagnation. Anything like sourness of root-run proves fatal to this mode of culture.

The tops should also be gone over daily; each shoot stopped at the joint showing fruit, and so on continually. The next leaf formed will have one or more fruit in its embryo, every one of which will swell under proper management.

All fruit should be cut when about three-quarters grown. It is the later development of the fruit, and the effort to form and ripen seeds, that proves most exhausting to the plant. During the earlier stages of the growth of Cucumbers, they drain the plants of but little strength, and no sooner is one removed than the growing strength seems to run at once into the new channels of successive Cucumbers. Hence, the Cucumbers should be cut daily, or at the least three times a week. After each cutting, one can almost see the succession fruit grow; and the weight of the produce may be doubled, as well as its quality kept up to the highest standard, by the simple and safe practice of early cutting.

No fruit must be kept for seed under this system, for two very good reasons: the first, which seems sufficient, viz., that little or no seed will be formed or ripened under express culture; the second is, that one Cucumber left for seed will probably rob the cultivator of at least fifty edible Cucumbers of the highest quality.

As this system develops an enormous amount of root force and power, it is not needful to sacrifice all this, even should the plant, after six months or more of bearing, show signs of exhaustion or distress. They may be cut back, more or less, as their condition may seem to require, and with liberal top dressings, and a continuance of all the express modes of forcing growth, the old plants will break into new vigour, and go on bearing even more plentifully than before.

Finally, the express system is the only remedy and antidote yet discovered for the Cucumber disease. The latter can be grown out and kept out by express treatment when all other methods have

failed, and hence it is well worthy of a trial by all who have suffered from this mysterious—and otherwise incurable—malady.

Neither need any amateurs or small gardeners hesitate to adopt the express culture of the Cucumber, because of their limited means or areas. In summer the whole practice may be best described as a simple method of bottling up and utilising sunbeams. Every glass-house, however small, if fairly well built, is a trap set to catch and hold these; and these alone, in favourable weather, combined with night coverings, would render the express culture of the Cucumber possible and fairly successful from May to October. Artificial heat and clear light render it possible at all seasons. But, just as all express trains do not run at the same speed, so in express Cucumber growing, the temperature and speed may vary as widely as from 75° to 120°; and with a mean of 90° many of the advantages of the system may be reaped, with less risk, perhaps, but in much longer time, than at higher temperatures. The principles are the same in each mode of express culture, though the speed may vary. These principles are incessant growth, perpetual bearing in a close semi-saturated atmosphere, a high temperature, full exposure to light, no checks nor exhaustion from any want of food or water at the roots, nor from over-bearing or seed-forming or ripening.

For this mode of culture plants raised from cuttings are to be preferred to those raised from seeds. Not only do they come into bearing much sooner, but they continue far more fertile. Under the high temperature and moist atmosphere needful to make the most and best of express culture in the least time, many of the branches near the ground will put forth roots. These cut off and planted seldom look behind them.

But failing these natural layers or cuttings, no plant roots more readily than Cucumber from cuttings of the ordinary kind. Growing shoots with one or two joints placed in the moist soil, pure sand, or blocked pots or bottles of water, damp moss or cocoa-fibre refuse, will be sufficiently well rooted to plant out in their fruiting quarters within a week or ten days of the time of insertion, and these will proceed to show and swell off Cucumbers at once, and will continue in bearing so long as desired. The propagation of Cucumbers by cuttings hastens production, and augments their fertility. Almost before seedlings have reached to the stage of rough or proper leafage, cuttings are showing or even swelling several fruits. This saving of time would be important under any system, but is of course still more so under express culture, as this renders the production of seed almost impossible.

GREEN-HOUSE PLANTS.

By William Hugh Gower.

Camellia.—The species of this well-known and highly popular genus of plants are natives of China and Japan, where they are found in a wild state, but have long been carefully tended in gardens by the lovers of horticulture in those countries. In Chinese paintings their chief favourites take a prominent position, the three principal being the Camellia, Chrysanthemum, and Abutilon.

Camellias are perfectly hardy in England, but as the flowers open in the early spring months their beauty as border plants is much deteriorated by wind and wet. On this account they are usually grown in the green-house, where, with their large symmetrical flowers and glossy dark green leaves, they form splendid ornaments during the dull months of winter.

Camellia japonica was the first kind introduced to Europe, and although the flowers of this species are only single red, it was considered a great acquisition at the time, which was in the year 1739; it is now entirely discarded, except for the purpose of grafting or inarching the better kinds upon.

Soon after the single red a double white form was introduced, which stands in good repute at the present time, and is known in gardens as the "old double white," or *Alba plena;* and after this several other double forms were brought to this country, showing that the almond-eyed gardeners of the Celestial Empire had long been busy with the improvement of the Camellia. So great a favourite has the plant become, and European gardeners have so persistently followed up the work commenced by the Chinese and Japanese, that the varieties now in cultivation in this country are very numerous.

In large establishments a house is frequently devoted to the cultivation of the Camellia, and under such conditions the plants are seen to the best advantage, because so treated the atmosphere and temperature can be regulated to suit their requirements, both in the growing and flowering stages. Nevertheless, it is not essential to good development, for with ordinary care good plants and an abundant crop of flowers can be obtained in a mixed collection of green-house plants.

Camellias thrive in either peat or loam, or in a mixture of both, and also in leaf mould; this latter soil is usually adopted by the Belgian gardeners, who use leaf mould as a substitute for peat, but the plants when imported to this country do not thrive well in it.

For growing Camellias quickly into fair-sized plants without a thought of flowers, we advise them

to be potted in peat, as it encourages a more rapid growth; but where short-jointed wood and a plentiful supply of flowers is the object in view, use about equal parts of peat and good turfy loam, with the addition of a little sharp sand. We have seen these plants grown in loam pure and simple; but although under this treatment an abundant crop of flowers are produced, the leaves to a great extent lose their rich colouring, and become a sickly yellow.

These plants will live and thrive for several years in the same pots; a little top-dressing, however, should be given in the spring of each year. But when re-potting is necessary, let it be done before the young growths begin to start, even if all the flowers should not have fallen off. Many practise a system of potting just as the plants have finished making their wood, but we are convinced from experience that if fresh soil is necessary for a plant, it must be most advantageous just at the time nature calls upon it to seek for fresh food, in order to develop new wood and increase its dimensions.

Double Camellia (*Mathotiana*).

In re-potting, avoid shifting into over-large pots; drain the pots well, and press the new soil down very firm. Camellias will not root with loose soil.

When growth commences, a closer and moister atmosphere is of great advantage to the Camellia;

but when standing in a mixed collection of plants, the special requirements of one class cannot be studied to the detriment of others. It, however, is always possible to find some part of a house which can be kept a little closer than another; and in such a position the Camellias should be placed. When growth is finished, and the wood and leaves have become somewhat hardened, they may be removed to the open air, and placed in such a manner as to prevent worms getting into the pots: here they may remain until autumn. After removing Camellias into their winter quarters, careful watering is very necessary in order to prevent the buds from falling; by careful watering we mean, the keeping the soil in such a happy medium, that the wood shall not shrivel through drought, nor the roots suffer from flooding; if either condition should occur, the result will be the premature falling of the buds. A free circulation of air is also necessary to insure good development of the flowers.

Soon after the plants are removed to their winter quarters, it will be necessary to look them over for the purpose of disbudding. If a large quantity of flowers are required, irrespective of size, very few buds will need removing; but where very large flowers is the desideratum, then one bud only should be left on each shoot.

The black and green fly often attack the young growths of Camellias; these, however, are easily destroyed by fumigating with tobacco, or tobacco-paper; fumigate lightly, and if all are not destroyed the first time, repeat the operation after an interval of two days.

White and brown scale also infest these plants at times; when these pests appear, a mixture of soft soap and a little paraffin oil, applied with a small stiff brush, will soon clean them off. This operation, however, must be done carefully, or the remedy may be as bad as the disease.

From the following varieties a good selection may be made to suit all tastes:—

A. Alba-plena.—The first double Camellia introduced to Europe, and one that is still much esteemed; pure white.

C. Archduchess Augusta.—Crimson; each petal with a central stripe of white; whole flower veined with bluish-purple.

C. Bealii.—Rich crimson; a superb flower.

C. Bonomiana.—Flowers beautifully imbricated; petals large and round; pure white, banded with rosy-carmine.

C. Chandlerii elegans.—Light rose, large, and very fine.

C. Circe.—Pure white. The flowers of this variety are small, and therefore valuable for bouquets, button-holes, and the decoration of ladies' hair.

C. Countess of Derby.—Large, pure white, flaked with rose.

C. Countess of Ellesmere.—A variable flower, but fine in all its forms; pure white, mottled with rose, sporting to rose flaked with white; flaked with white or flesh-colour; and striped with carmine.

C. Comtessa Lavinia Maggi.—Large fine form; pure white, regularly striped with broad bands of carmine.

C. Cup of Beauty.—Beautifully imbricated; pure white, striped with rose.

C. Duchesse de Berri.—Beautifully cupped and imbricated; pure white, exquisite form.

C. Duke of Lancaster.—Large, fine form; full deep rose.

C. Emperor Napoleon III.—Rose, veined with crimson, and bordered with white; well imbricated.

C. Fimbriata.—Pure double white; beautifully fringed.

C. Gem.—Large, cupped, and beautifully imbricated; carmine, with pink centre.

C. General Cialdini.—Rose-carmine, striped with red; finely imbricated.

C. Imbricata.—Deep scarlet; fine form.

C. Jenny Lind.—Waxy white, striped with rose; fine form; finely imbricated to centre.

C. Jubilee.—Pinkish-white, dotted and splashed with rose; fine form.

C. Lady Hume's Blush.—Waxy white, suffused with delicate flesh-colour; its size renders it very useful for bouquets.

C. Madame Ambroise Verschaffelt.—Rosy-white, striped and spotted with carmine; fine form.

C. Mathotiana.—Brilliant rich crimson; large, and beautifully imbricated.

C. Mathotiana alba.—Large; finely imbricated; pure white; extra.

C. Mrs. Cope.—White, tinged with pink, and speckled with rose; very double.

C. Pearl.—Pearly white; petals round and of good substance; perfect in form; extra.

C. Prince Frederick William.—White, flaked with carnation; fine form.

C. Princess Mary.—Brilliant crimson; large; fine form; extra.

C. Queen of Beauties.—Blush, veined with pink; very delicate and handsome.

C. Queen of Denmark.—Deep crimson, shaded with rose, and striped with white; large and fine.

C. Reine des Fleurs.—Vermilion-red; large and fine form; extra.

C. Stella Polarie.—Bright crimson; centre of each petal striped with a line of white; well imbricated, and very handsome.

C. tricolor imbricata plena.—Soft rose; each petal broadly striped with crimson; large, double, and finely imbricated.

C. Trionfo di Lodi.—White, streaked with rose; beautifully imbricated.

C. Valtevareda.—Bright rose, often spotted with pure white; large and beautifully imbricated; extra.

C. Virgine de Colle Beato.—Pure white; petals spirally imbricated; a charming flower; extra.

C. Virgine Franco.—Pink and white, streaked and spotted with red; good shape.

C. Wilderii.—Soft rose; fine form; beautifully imbricated; extra.

Campsidium.—A genus belonging to the *Bignoniaceæ*, requiring the same treatment as *Bignonia*, which see.

C. chiliense.—A conspicuous climber, but its beauties appear to be little known, or it would be more frequently seen in our plant-houses. The whole plant is quite smooth; the petioles are winged, and the closely-set leaflets are sessile, oblong lanceolate in shape, very sparingly toothed, and dark green; the racemes are terminal and pendulous, bearing numerous bright scarlet tubular flowers. Spring and early summer. Chili.

Canarina.—A genus of *Campanulaceæ*, which contains one species only; this is tuberous-rooted, the stems dying down, and the plant remains in a dormant state for several months in the year.

The soil should be equal parts of rough peat and loam, and a warm corner of the green-house should be assigned to it when growing. Propagation by division.

C. campanula.—This plant seems to have been introduced to our plant-houses so long ago as the year 1696. The root is tuberous and milky, producing soft hollow stems, which are sparingly furnished with thin, opposite, shining light green leaves. The flowers are large, pendulous, bell-shaped, and yellowish-orange, a shade of colour very rarely met with in this order. The season of its blooming much depends upon the time it is started into growth, but the early spring months would seem to be its usual time. Canary Islands.

Cantua.—This genus contains but few species, and these are too seldom seen; they are all natives of Peru, and require about the same treatment as Fuchsias; for soil, use a mixture of peat, loam, leaf-soil and sand, in about equal parts. Drain the pots well, and stand the plants in a good airy position.

C. buxifolia, as its name implies, resembles the Box, but sometimes they become lobed. Flowers tubular, some four inches long; tube crimson; limb spreading; deep rose-colour. May and June. 1846.

Ceratostema.—A genus belonging to the order *Vacciniaceæ*, which is very nearly allied to the Heath family. The order is not extensive, but it contains a great quantity of very beautiful plants, amongst which the single species of *Ceratostema* here enumerated takes first rank.

The whole of the plants in the order to which *Ceratostema* belongs are rather difficult to cultivate; they require about the same treatment, and to avoid repetition when describing other members of the *Vaccinieæ*, we will refer to *Ceratostema*.

The soil for these plants should be a mixture of rough sandy peat and a little light loam. The pots must be drained well, as they like an abundant supply of water; the atmosphere should be kept rather moist, but there must be a free circulation of air. These plants thrive well with Camellias, but they like an abundance of light.

C. speciosum—A strong-growing plant, with a thick woody root-stock, from which the branches spring; leaves alternate, simple, ovate, dark green; flowers axillary in small clusters, some three inches long and pendulous, tubes, crimson-scarlet, tipped with yellow. Summer months. Ecuador.

Chamœrops.—A small genus of Fan Palms, found growing farther north than any other members of the order, one species coming even so far north as Nice.

They are handsome plants, having their leaves plaited, round, or fan-shaped, with numerous segments, which are deeply divided. The petioles are long and stout, usually furnished with spines at the edges, and enveloped at the base in a dense mass of rough fibry tissue. The flowers are numerous, produced in branching panicles from the base of the leaves. The flowers, however, are inconspicuous, and are succeeded by a large one-seeded berry. The soil for their culture should be rich loam, with some sharp sand added. Chamœrops enjoy an abundant supply of water; therefore their pots should be thoroughly drained.

C. Fortunei (the Chusan Palm).—This species, the correct name of which is *Trachycarpus Fortunei*, named in honour of the celebrated traveller Fortune, is a sturdy-growing plant, which has proved hardy in various parts of this country; but, nevertheless, it does not seem to luxuriate, for in such situations it grows but slowly, and does not appear happy. As a green-house ornament, however, the case is altered; here it is more vigorous, and its leaves attain a much superior development. Grown in tubs or large pots, it is a splendid object for the embellishment of the sub-tropical garden in summer.

The leaves of this plant are supported upon long unarmed petioles, and are in the form of, and plaited

like, a fan. They are divided into narrow segments about half-way down, and are of a uniform deep green. It forms a large umbrella-like head, and is a very effective ornament. North of China.

C. humilis (the European Fan Palm).—Attains a height of twenty to thirty feet, but it frequently produces numerous suckers from the base, which prevent it from attaining such proportions, and is then by no means so ornamental. The petioles are long, and armed at the edges with sharp spines. Leaves fan-like, divided into narrow segments for about a third of their length, and glaucous on both surfaces.

In the South of Europe the leaves of this species are extensively used for hat, broom, and basket making, and are very durable. The Arabs in Northern Africa also employ them for covering their tents, &c.

There are several recognised varieties of this species, amongst which may be noticed *C. arborescens* and *C. macrocarpa*. It is found in great abundance in Southern Europe and Northern Africa.

C. Palmetto (correctly, *Sabal Palmetto*) is very ornamental, but slow in growth; leaves fan-shaped, divided into numerous long narrow segments of a glaucous hue. Southern States of America.

CHAMÆROPS HUMILIS.

Cheirostemon.—This genus of *Sterculiads* contains but one species, which in its native country attains a height of eighty to a hundred feet. It is popularly called the Hand-plant in this country, but at the present time is very rare in cultivation. The only plant known to exist for some time was a very ancient specimen found growing at Toluco, near the city of Mexico. By the Mexicans it was held in

great veneration, and was called by them "Macpalxochitlquahuitl." It should be grown in light turfy loam and peat, and the drainage must be kept open and in thorough working order.

C. platanoides is a large tree, but assumes its true resemblance to an infant's hand. It appears to be indigenous to Guatemala.

Chorozema.—A genus of handsome Australian shrubs, which, like so many of the plants from that

CHEIROSTEMON PLATANOIDES.

characters and flowers in a comparatively small state, with large heart-shaped leaves, which are deeply-lobed dark green on the upper side, clothed beneath with a ferruginous tomentum; the flowers are destitute of a corolla, the calyx is unusually developed, and the stamens, which are five in number and bright red, are very long and united at the base, and so turned that they have a somewhat striking country, belong to the *Leguminosæ*, or Pea-flowers. They are somewhat straggling in habit, but by judicious pruning after the flowering season is past they may be easily grown into good plants, when they are simply invaluable as decorators of the green-house or conservatory. The soil they thrive best in is a mixture composed of two parts peat, one of loam, and one of sharp sand. Propagated by cuttings.

C. cordatum.—Leaves heart-shaped, armed at the edges with prickly teeth; flowers freely produced in loose racemes; red, spotted at base with orange-yellow. April and May.

C. Henchmanii.—This elegant species is very liable to attacks of mildew; but if kept in a well-aired situation, and slightly dusted with sulphur at intervals, no harm need be apprehended. The leaves are small and Heath-like. It produces long racemes of Pea-shaped flowers, which are bright scarlet, with a green spot at the base. April to June. 1824.

C. Lawrenciana.—A strong-growing kind, and a profuse bloomer; flowers orange and scarlet. May. 1845.

C. Dicksonii.—This is perhaps the largest-growing kind in the family, but rare in cultivation; scarlet and yellow. May. 1836.

C. varium.—Is more compact in habit than the other kinds, with large dark green leaves, and forms handsome specimens; orange and red. 1837.

Citrus.—This is the systematic name for the family of plants which produce that luscious fruit, the Orange—a boon to the invalid upon a bed of sickness, parched, it may be, with a burning fever, and the joy of a schoolboy's heart at any time.

Citrus Limonum.

The fruits which are known as the Orange, Lemon, Citron, Shaddock, &c. &c., are all supposed by some to have been derived from one species, *Citrus Medica*, found in cultivation by Theophrastus in Media. It is not, however, found wild in any part of Persia, although at the present time it may be found in a state of nature in the mountain valleys of Northern India; and although the fruits are now so various and distinct in appearance, this no doubt has been brought about by long cultivation and selection. The Orange appears to have been cultivated by man at a very early period. It was common in the North of Persia several hundred years before the birth of Christ, and the Jews appear to have brought it with them to Palestine on their return from captivity in Babylon. From the land of the Jews it was brought into Italy by the Romans, and in Spain we read that Oranges were in cultivation about Seville towards the end of the twelfth century.

The first recorded Orange-trees in England were those reared by Sir Francis Carew at Beddington, in Surrey. These, it is said, were brought to this country by his relative, Sir Walter Raleigh; but it is unknown if these were established plants, or seeds only. They were grown against a wall in the open air, and bore large crops of fruit, but were killed by the great frosts in 1739—40.

It is not the intention to treat in these pages upon the cultivation of Oranges in England as a commercial speculation, for they cannot be grown in this country without protection in winter; nevertheless, a few notes from a visitor to the Orange gardens in the Azores will not be out of place. Our friend says:—"The Orange-tree succeeds everywhere in the Azores, even in poor soil, although it prefers the richer, and the sea-air is favourable to it. At one time grafting the good kinds upon seedling stocks was the only system of propagation; now, however, they are largely propagated by layers; this latter operation should be performed from about the middle of May up to the middle of June, and by the beginning of the next year they will be fit to remove from the parent plant.

"The cultivators in the Azores say that plants from layers fruit quickest, but grafted plants produce the best fruit.

"A danger the Orange-trees have to withstand is the boisterous winds which are so prevalent in the Azores, and which at times are so violent as to uproot them. This has led to the planting of various trees in rows as shelter to them, but since these trees have become large enough to shade the Orange-trees they have produced fruits with thicker rinds, which is detrimental, as the fruits with thin rinds are better in flavour and travel better. About the tenth year the trees arrive at a fair fruiting state, that is to say, each tree will yield some 1,500 to 1,600 fruits; but when another five years have passed the yield will be doubled, and it is recorded that trees have been known to yield upwards of 20,000 fruits.

"A disease called *lagrima* is very injurious to these trees. The bark cracks near the base of the stem, and a viscid gum exudes. This is followed by the bark peeling off, and the wood and roots decay, and the tree dies. The plan adopted where this disease shows itself is to make a large incision where the bark has split, in order to allow the gum to run away as quickly as possible. The soil is then re-

moved from the roots, which are sure to be found in a bad condition. These are then carefully pruned, and fresh soil placed around them. Notwithstanding the paucity of kinds to be found in English gardens, great attention is paid to them in St. Michael's, where upwards of a hundred different kinds of Oranges are to be found."

The Orange as an ornamental tree in our greenhouses has been of late years much neglected, but it is curious to note that, although Orange-blossom has lost none of its charms or attractions for the fair sex of these realms, the plant has lost favour with cultivators, and consequently we have to import it in most instances for bridal festivities, which is certainly a disgrace to English horticulturists.

Citrus Medica.

In the olden times of English gardening, an Orangery was considered indispensable; and, although the structures then used were quite the reverse of those used in the present times, plenty of fine trees existed in England. The finest collection of Orange-trees we have seen is that in the Gardens of the Royal Palace of Sans Souci, near Potsdam in Prussia, where they are accommodated in a noble house, about a thousand feet in length, forty-five feet broad, and about twenty-five feet high. These are cultivated in tubs, and during the summer months are all brought out upon the terraces in front of the Palace, where they produce a wonderful effect, and the air is quite laden with the exquisite perfume of their blossoms. Some very fine trees at Holland House, Kensington, have for many years been treated in the same manner with the best results.

As before remarked, Orange-trees will thrive in even poor soil, but they prefer generous treatment, and the compost best suited for their healthy development is a mixture of rich loam, leaf-mould, peat, and manure, in equal parts. The manure should be old, and obtained from cows, sheep, and fowls. This, being in a nice friable condition, should be well mixed, adding some sharp sand. It should be used in a tolerably rough state, as these trees thrive best in open porous soil; thorough drainage is indispensable. The whole of the Citrus family enjoy a liberal supply of water when growing, and when given it must be in such quantities as to penetrate the soil thoroughly, yet before another watering the soil should show signs of becoming dry. They enjoy occasionally applications of liquid manure, or mulchings of old cow-manure when in full growth will be found very beneficial.

Although Oranges like an abundance of light, full exposure to the sun under glass is apt to burn the young leaves or turn them yellow, which is very detrimental to their appearance, therefore some little shading will be found advantageous during the hottest part of the day.

The fruits of the several varieties are largely imported for the dessert-table and various economic purposes, and of late years a considerable quantity of the young stems have been brought to this country for walking-sticks.

C. Aurantium (the Sweet Orange).—A bold-growing, handsome tree; leaves winged, broadly oblong, and shining green. Under cultivation it produces immense crops of golden fruit, which are too well known to need description. The flowers are white and deliciously fragrant, largely used for decorations in bridal festivities. Like all plants that have been long under cultivation, the Sweet Orange has produced many varieties, one of which is known as the Malta, or Blood Orange, the fruits of which are rather small, and the pulp is deep red or blood-colour throughout. The Mandarin is another variety, which fruits in quite a small state. Leaves ovate and bright green. The fruits are small, deep orange-colour, the rind is thin, and the pulp is very sweet. It is called the Noble or Mandarin Orange in China, and is largely grown in the Azores. The Sweet-skinned Orange is another very distinct variety. It has a small rich yellow fruit, the rind being soft and very sweet. In the French shops this is sold under the name of Pomme d'Adam, and called the "Forbidden Fruit," but it is quite different to the fruit sold in London under that name. The fruits of the Sweet Orange are largely imported from Lisbon,

the Azores, and Malta. Recently Australia has sent some to London, but as in all cases these are gathered before they are quite ripe, excellent as the flavour is, they cannot compare with a fully ripe fruit, fresh-gathered from the tree. It has been in cultivation in various parts of the world for ages, and is still found wild in the valleys of Northern India.

C. Bigaradia (the Seville or Bitter Orange) forms a handsome plant, with ovate, broadly-winged, dark green leaves; fruit rough, very dark, with an extremely bitter rind. It is largely imported from Spain for preserving, as candied-peel, marmalade, &c. The Myrtle-leaved Orange is a variety of this kind.

C. Bergamia (the Bergamot Orange).—Tree spiny. It bears a small pear-shaped fruit; the flowers and fruit are both fragrant, and from them is obtained the essence called Bergamot-oil.

C. decumana (the Shaddock).—A bold tree, with broadly-ovate winged leaves, and very large fruits, sometimes measuring two feet in circumference, and weighing from ten to twenty pounds. The rind is pale yellow, pulp pale red, slightly acid, very cooling and refreshing. They are to be found in the London markets under the names of Pompelmousses, Pompoleons, and Pomaloe and the small-sized ones are sold as the "Forbidden Fruit." It is a native of China, and is largely cultivated in Jamaica and various parts of the West Indies, where it was first taken by Captain Shaddock.

C. Limetta (the Lime).—This forms a handsome tree, with large ovate leaves and pale yellow fruit. The pulp is acid and bitter, but rather flat. It, with the Lemon and Citron, produce the Lime-juice so useful as an antiscorbutic. The plant called by the Italians *Pomo d'Adamo* is a variety of the Lime.

C. Limonum (the Lemon) is a handsome plant, and comes into a bearing state quite young. The fruits are too well known to need description. There are many varieties. It is found wild in Northern India, and cultivated largely in the West Indian Islands, and is a valuable article of commerce.

C. Medica (the Citron) is a spiny-branched tree, with oblong pale green leaves, flowers purplish outside, white within, fruits ovate upwards, of six inches long, with a rough citron-yellow rind, which is spongy and very fragrant. It is preserved and sold as candied-peel. The pulp is slightly acid. It yields the Oil of Citron and the Oil of Cedra of commerce. Found wild in Northern India, but has been cultivated in various parts of the world for many centuries.

C. japonica, a native of China and Japan, where it is called Kumquat. It is a plant of medium growth, and produces a handsome appearance. It bears an abundance of bright yellow fruit of exquisite flavour. These are sent to this country preserved whole, and meet a ready sale.

Clethra.—A genus of *Ericaceæ*, most of which are natives of America. The species quoted here, however, is indigenous to Madeira, and becomes a stately green-house tree, although if properly cultivated it will bloom in a young state, and thus may be accommodated in houses of small dimensions. It has been in cultivation in this country for a hundred years, but is less frequently seen than it deserves.

The soil should consist of two parts peat, one of light loam, and a little sand. Young plants should be allowed to become pot-bound, when they will flower freely; but if large plants are required they must be re-potted frequently and kept growing. The coolest part of the green-house suits this plant best.

C. arborea.—A free-growing, handsome shrub, with oblong acuminate leaves, which are serrated at the edges, smooth and bright green on the upper side, paler below; the racemes of flowers are much branched, bearing numerous pure white flowers, resembling large spikes of Lily of the Valley. Summer months. Madeira.

COMMON GARDEN FLOWERS.

SNAPDRAGONS, HYDRANGEAS, PÆONIES, MICHAELMAS DAISIES.

The Antirrhinum, or Snapdragon.—Time was when this fine and handsome biennial was included among the florists' flowers; and even at the present time batches of seedlings are named by the Scotch raisers, and included under the head of "new florists' flowers." The type of flower noticed under this heading is *Antirrhinum majus* (the Great Snapdragon). Antirrhinum is a compound of two words meaning a snout or nose; the flowers being like the snout of an animal; and this resemblance, no doubt, gave rise to the common name, Snapdragon. It is not a native of Britain, but it so abounds that it might be regarded as a native plant; it is very frequently found growing on old walls and buildings, in which places plants will endure for several years, and it is truly remarkable what large plants will grow with their roots depending entirely upon the moisture in the walls for support. In such positions the plants become true perennials; whereas, when placed in gardens, it seldom lasts longer than two years, and therefore it is classed under the head of "hardy biennials."

Thirty years ago Mr. John Riley of Huddersfield, took in hand and greatly improved the Antirrhinum by means of careful selection and high cultivation; and it appears to be a statement scarcely credible, yet nevertheless true, that Mr. Riley grew plants six and seven feet in height, and four feet in diameter; and these wonderful plants were not seedlings, but raised from cuttings made the previous autumn.

The Antirrhinum is a plant quite easy of cultivation; but our advice is, if any one attempts to grow it, let it be something worthy of their best care. The best way to begin would be to send about the month of May to Messrs. R. B. Laird and Sons, of Edinburgh, who are now generally admitted to be the most successful cultivators of these flowers, and obtain a half-dozen or dozen plants of good named varieties, of distinct character. These can come by post with the soil shaken from the roots, and as soon as received they should be potted singly in small spots in light rich soil, and put into a cold frame, or under a hand-light for a few days, taking care that they are not eaten by slugs or snails. When they have established themselves and begin to grow, they should be planted out in a bed or border, again in good soil, and encouraged to grow as freely as possible. They will flower in August or September, but quite early enough to enable the grower to get a few pods of seed for his own sowing. During the summer the plants should be looked after, tying them neatly to stakes to keep the wind from blowing them about; watering when necessary, and keeping the soil about the plants free from weeds.

ANTIRRHINUMS.

S'riped (Swanley Beauty). Crimson (Faust).

But after the seed is gathered, there is no reason why the plants should be wasted. There is always a risk in keeping old plants safely through the winter; not but what they are perfectly hardy, but the plants really suffer more from damp than frost; and the latter following close on heavy rain is certain to be fatal to them. The grower should therefore take cuttings of the best varieties, doing this at the end of August, putting a few into pots of light sandy soil, well drained, of course, and placing them in a cold frame. As soon as they are rooted—and they root quickly — they should be potted singly in small pots, using the same kind of soil, and wintering in a cold frame. These can be planted out in the open ground by the end of March, and they will flower in June and July. In this way a few very fine varieties can be continued each year; but seed taken from fine sorts will be certain to produce beautiful flowers.

But when is the best time to sow seeds? Supposing, as before mentioned, some seeds be gathered in September, it can either be sown at once, or in early spring. If a little bottom heat can be used, we should say defer sowing until February. But the seed can be sown in autumn in pans or shallow

boxes of light sandy soil, placing them in a frame or greenhouse. The seeds will soon germinate, and the plants should be protected from frost during winter, and pricked off into boxes or pans in early spring, and grown in as quickly as possible. Or the seeds can be sown in February in seed pans, placing them in a gentle heat, where the seeds will quickly produce plants, and allow them to remain there until the plants are from two to three inches high. Then prick them out into boxes or pots, about two inches apart, and gradually harden them off till the weather is sufficiently mild to plant them out in a bed of good rich soil. Treated in this way the plants get into good size early, and flower about August. This is making the Snapdragon an annual. Then a sowing can be made about July in pans or boxes, placed in a cold frame; and in September or October the young plants can either be planted out in a bed in a cold frame to winter, or be placed out in the open ground. A somewhat warm sheltered border is best; young unbloomed plants winter much better than those that have flowered the previous summer; and seedlings raised from seed sown in July will flower much earlier in the following summer than those raised from heat in February of the same year.

The plants that flower in July may have all their flower spikes cut away as soon as the beauty is over, leaving only a very few from which it is desirable to take seeds; and they will throw out fresh growths that will bloom in October and November if the weather is mild. The second blooms will not be so large as the first, but the plants will be more compact at growth; and, because it is the autumn season, the colours if anything more brilliant.

There is a very dwarf section of Antirrhinums of Continental origin known as Tom Thumb. They do not rise much beyond six inches in height, and some not so high as this. The seedling plants form dense tufts, and they throw up six or eight or more pretty spikes of flower. Any one with a liking for Tom Thumb Antirrhinums should sow a little seed every year; for if the plants are left over for two years they grow a good deal taller. The seedlings can be raised in just the same way as those of the taller-growing section.

The colours of the Antirrhinum vary very much. Some of the flowers are self-coloured; some beautifully striped and flaked; others bi-coloured and tri-coloured. On some plants two or three different-coloured flowers can be seen at once. And we conclude by saying that all lovers of hardy garden flowers should grow a few pretty Snapdragons.

Selection of Named Antirrhinums.

Ada, striped.
Abel, Grand, striped.
Cluny, dark crimson.
Canary, white and crimson.

Selection of Named Antirrhinums (*continued*).

Cherub, white and rose.
Comus, yellow and claret.
Duard, deep crimson.
Gipsy, sulphur and rose.
Golden Gem, yellow.
Hendersonii, white and carmine.
Jewel, cream.
John Dowrice, rich carmine and white.
Monarch, orange-crimson.
Ophir, deep yellow and rose.
Sunrise, rosy-lilac.
Sylph, white and rose.
Sunshine, rosy-crimson.
Themis, fine striped.

Hydrangea.—The common Hydrangea of our gardens is *H. hortensis*, which was introduced from China nearly a century and a half ago. There are a few American species, not generally known, to be found in botanical and other gardens, and generally of a thoroughly hardy character. The common form is a little more tender, and yet much hardier than is generally supposed; standing well in the southern and western parts of England and round London, though always liable to be cut down in severe winters. When it is cut down to the ground, it invariably springs up again luxuriantly the following year. In exposed positions it is wise to cover the crowns of the plants during winter with litter, so that if severe frost comes, and the branches are destroyed, no harm shall come to the roots. Hydrangeas should be planted in good soil when placed in the open ground, and if the covering recommended in winter be in the form of some fertilising material, the plants will be greatly benefited thereby. In spring, when the young growths come up from the bases of the plants, the thin ones should be cut away, and only the strong ones allowed to remain; and the old wood should be thinned out in the same way.

The Hydrangea makes an admirable conservatory and forcing plant, and it is largely grown for market purposes. Small plants, having one or more stems, surmounted by very large heads of bloom, can be seen in the public streets of London in early summer, and it is remarkable that such splendid plants can be grown in such small pots.

Cuttings taken in spring strike freely in sandy soil and a light bottom heat. The usual plan is to put one cutting in a 3-inch pot, as soon as it is sufficiently rooted, giving them a compost made up of good turfy loam, leaf mould, and sand to grow in; and applying plenty of water at all stages. After the growth is made, the plants are exposed to sun and air to ripen their wood. In November the plants are placed in heat, and when the flower-heads appear the plants are stood in pans of water, for at this stage a good supply of water is necessary. The market growers adopt the practice of taking cuttings from the plants in August, or as soon as the buds have become hard and the plants are ripening their growth; they are placed singly in 5-inch pots in a slight bottom heat, but not sufficiently brisk to incite them to

growth, or they will prove useless. The growth from these buds in spring produce flowers.

It is well known that the flowers of Hydrangeas will frequently turn blue. This is entirely owing to a certain condition of the soil, which means the presence of oxide of iron. In some districts of Ireland, where the oxide abounds in the soil, the Hydrangeas take on very rich tints of blue, and the plants attain to a great size. It is said that where iron-filings and a solution of alum are used, in some soils the blue colour is produced, while the same means will not produce it in others; and other soils will invariably produce this blue colour without any peculiar matter whatever being added. The loams at Kenwood, at Hampstead Heath, and Stanmore Heath, and the peats at Wimbledon, as well as some bogs near Edinburgh, are famous for producing this blue in the Hydrangea. Cuttings have frequently been taken from plants bearing blue flowers, but the plants generally produce pink-coloured blossoms.

H. Thomas Hogg is a very fine and distinct white-flowered form of hortensis obtained from America. *H. stellata prolifera* and *H. paniculata grandiflora* are two Japanese types that should be treated as ordinary greenhouse plants, though in warm positions both will succeed in the open air. The last-named is a fine object in the conservatory when bloomed in pots.

Tree Pæony (Single Form).

The Pæony.—There are two distinct sections of Pæonies—one is the Tree, or Moutan, the other the Herbaceous. "Pæony" is derived from Pæon, a physician, who used the plant medicinally, and at that time the roots of the common Pæony (*P. officinalis*), which was introduced to Europe some 350 years ago, were held in high repute as powerful antispasmodics, and as one of the most efficacious remedies against epilepsy, convulsions, and hysteria; but they are now totally disregarded for any medical properties they may have been supposed to possess. It would appear that about the time that the common crimson-flowered *P. officinalis*—or, as it is sometimes termed, *P. herbacea*—was introduced to England, *P. albiflora*, a white flowered form, came at the same time. From these two have sprung many varieties, but the crimson-flowered types are most common in gardens. Of varieties there are a large number, and of many shades of colour, from white to deep purplish-crimson. One catalogue gives quite 160 varieties, classed under the name of *P. herbacea*. They are nearly all double; a few single. The Pæony is a plant that does well in the open border, flourishing in any good loam where it can root firmly and find moisture during the summer months. When planted, they should be put in rich soil, and some mulching with manure will be found very useful during winter and spring. Some have richly fragrant flowers.

The following is a selection of choice varieties:—

Alba sulphurea, creamy-white.
Anemonæflora, crimson.
Artemise, rosy-pink.
Candidissima, pure white.
Charles Binder, lilac-purple.
Duchess of Orleans, lake and salmon.
Doyen d'Enghien, red, margined white.
Eugène Verdier, rosy-pink and blush.
Humea alba, rosy-white.
Jeanne d'Arc, rosy-pink.
Lutea plenissima, pale yellow.
Madame Chaumy, satiny rose.
Madame Vilmorin, blush-white and crimson.
Magnifica, delicate pink.
Oberlin, rosy-lilac.
Prince Prosper, deep crimson.
Prolifera tricolor, white and yellow.
Pulcherrima, satin-rose and white.
Queen Perfection, white and yellow.
Queen Victoria, blush.
Rosamond, bright rosy-pink.
Speciosa striata, rose and white.
Splendida, bright rose.
Surpasse Pottsii, purplish-crimson.
Tenuifolia, deep blood-red.
Versicolor, rich rose.
Virginie, blush and pink.
Whitleyi, single white.

Tree Pæony.—This is *Pæonia Moutan*, perhaps better known as the Moutan or Chinese Tree Pæony. This and several others, mainly varieties, were introduced from China between 1789 and 1846. The flowers of these Pæonies must be truly magnificent in their own country, for we are informed on high authority (*The Gardener's Chronicle*, of June 4th, 1864) that "the common varieties—that is, those which have been in cultivation in our gardens for many years—beautiful though they are, give but a faint idea of the beauty of these other kinds which have been lately introduced. The flowers of the older sorts are mostly light-coloured—white, blush, or pink—and they are generally only semi-double. It used to be

said that these Chinese had a yellow variety, also one with black flowers, and a double blue one, which, however, was only to be met with in the Emperor's garden. The latter produced blooms of extraordinary size, each having from 100 to 1,000 petals. When China was partially opened to foreigners in 1842, a search was made for these famous Moutans, and many fine kinds—more than thirty, we believe—were discovered and introduced into England. Amongst these, it was true, there was no real yellow or true blue; but there were dark and light purples, lilacs, and many shades of red of great beauty. One was almost black in colour—indeed, it was known as the Black Moutan amongst the Chinese—while another was straw-coloured, and was called the Yellow Moutan. Most of the flowers of these plants were very double, and one at least was sweet-scented. Some of these varieties produce flowers of unusual size, and were their petals counted they might prove as numerous as those of the plant of the Emperor's garden above referred to." We owe the introduction of these new varieties to that enterprising traveller, the late Mr. Robert Fortune.

Tree Pæony (Double Flower).

The Common Pæony is a hardy herbaceous perennial, the foliage dying down to the ground in the autumn. The Moutan Pæony is a tree, shedding its leaves during the winter, and unless occupying a suitable position, likely to be injured by severe frosts. If the summer proves cold and wet, the wood is imperfectly ripened, and when the severe winter follows, the constitution of the plants is impaired. On dry gravelly soils they form stately plants, and we have seen them used with great effect planted singly on lawns. Here they flower freely, and are objects of conspicuous beauty. In early spring, when the young shoots are being put forth, they are liable to injury from frost. All that is wanted is a slight protection in spring, a warm summer to ripen the wood, and cold in winter, so that the plants may go completely to rest. Cold situations and windy corners are not the places for Moutan Pæonies. The plant seems to love a fresh strong loam; and it does not disagree with a slight infusion of peat, though that is not necessary. For young plants a compost made up of well-rotted turf and leaf mould is very suitable. Moutan Pæonies can be propagated by layers, or by pulling to pieces an old plant; and every precaution should be adopted to induce a vigorous growth, for then the flowers are certain to be very fine.

The following is a selection of choice varieties of Moutan Pæonies:—

Alba lilacina.
Blanche Noisette.
Carmesina plenissima.
Candida.
Elizabeth.
Fragrans plena.
Horatiana.
Incarnata plena.
Lactea.
Madame de Vatry.
Maxima plena.
Moutan, double.
Osiris.
Purpurea violacea.
Queen.
Reine des Fleurs.
Robert Fortune.
Speciosissima.
Splendens.
Stella.
Triomphe de Milau.
Van Houttei.
Ville de Versailles.
Vivid.
Walmerii.
Zenobia.
Zariana.

Michaelmas Daisies.—These are really perennial Asters, or Starworts, and Aster means a star. They are called Starworts because the florets are collected together on a receptacle, as in the case of the Daisy or Dahlia, and the rays of their circumference resemble stars. They are doubtless called Michaelmas Daisies because they flower in August and September, and right on into the autumn. They are none of them indigenous to this country, but have come from different parts of Europe and other places, and of late years many fine varieties of originally introduced species have been raised in this country. There is now a large group of perennial Asters, containing more than a hundred species and varieties, the greater portion of which are worthless for decorative purposes, though some of them can be met with in country and cottage, and especially what are termed old-fashioned gardens. These are mostly tall, gawky things, though they flower very abundantly in autumn. But some of them, and especially more recently-raised varieties, are excellent autumn-blooming plants. They are all herbaceous perennials, their foliage dying away in winter, but renewed by young growths in spring, and they do well in any ordinary garden soil, though the richer it is the finer will be the plants and flowers alike. Any variety can be largely increased by division of the roots, or by cut-

tings made of the young growths in spring. The plants flower best when they are fully established, so it is wise not only to plant them in good soil, but where they can remain for a few years. Some of the varieties are weaker growers than the others, and it is recommended that they be renewed by means of cuttings or root-division every two or three years. The different varieties vary both in the size of their flowers and the colours of the same, but blue, purple, and lavender shades preponderate.

A very select collection can be found in the Nurseries of Mr. Thos. S. Ware, the Hale Farm, Tottenham, and other places. Mr. Ware has made a selection of the very best varieties, and we give a list of the finest found in his collection, which is generally taken as the standard. They represent the entire genus, and contain a number of first-class sorts, remarkable either for colour, size of flower, or abundance of bloom, and can be recommended for general cultivation :—for the decoration of the open border, for massing, &c. Some few make fine rock plants, while the dwarf compact-growing varieties are very pretty in pots, and they are also found very useful for cutting from.

ASTER AMELLUS BESSARABICUS.

Our selection is as follows :—

Alpinus, pale lavender-blue, orange centre, flowers two inches in diameter, from six to nine inches in height, fine for the rockery or border.

Amellus, large violet blossoms with yellow centre, very free flowering; height two feet.

Amellus Bessarabicus, a fine variety of preceding, with rich purplish-blue flowers with orange centres; height two feet; one of the finest.

Chapmanni, bright lavender flowers, one and a half inches in diameter; a distinct and beautiful species.

Cyaneus, bright mauve flowers, very abundant; four feet high, one of the latest in flower.

Discolor, white flowers, changing to rosy-pink, about one foot in height; very distinct.

Dumosus, flowers bright purple; two and a half feet high, flowering in September; one of the best.

Ericoides, white, with yellow centres, flowers small, but very abundant; three and a half feet; flowering in October; one of the most elegant of this genus.

Formosissimus, a distinct and beautiful species; height four feet; flowers rosy-purple, very large, and exceedingly free blooming, a fine variety.

Grandiflorus, one of the latest and most beautiful of this family, flowers large, of a rich purplish-blue.

Lævis, bright lilac, yellow centres, flowers large and abundant; a distinct species; four and a half feet.

Longifolius var. formosus, a pretty dwarf-growing variety, forming symmetrical bushes about two feet high, covered for a long time with bright rose-coloured flowers.

Multiflorus, small white flowers, but very numerous; a distinct and useful variety; two and a half feet.

Novæ Angliæ, rich bright rose, with orange centres; flowers large; one of the most distinct of the tall varieties.

Novæ Angliæ rubra, a fine variety of preceding; flowers bright magenta, five feet, later flowering than preceding.

Novæ Belgiæ, large bluish-purple flowers; growing five feet high, and form immense heads of bloom; one of the most conspicuous of the late-flowering group.

Paniculatus, white flowers, one and a half inches in diameter; a distinct and useful species; four feet.

Pilosa, blue flowers; five feet high, flowering in October.

Polyphyllus, flowers of medium size, white, very abundant, flowering in August; grows four feet.

Pyrenaicus, flowers large pale blue; one and a half feet high; one of the earliest.

Salsuginosus, large white flowers, with yellow eye, one and a half inches in diameter; flowering from June to November; two feet high.

Shorti, flowers lavender-blue, and very abundant, flowering in August; height two and a half feet.

Turbinellus, flowers pale rosy-purple; three and a half feet high; very showy and distinct.

Versicolor, white, shading to rose; flowers in masses in August; effective; four feet.

THE KITCHEN GARDEN.

By William Earley.

Onion (*Allium Cepa*). French, *Ognon;* German, *Zwiebel;* Spanish, *Cebolla;* Italian, *Cipola.* — The Onion is a biennial plant, the origin of which is not known, though a probable native of Spain. Few more highly-finished bulbs are turned out of nature's workshop, whilst its fistular leaves and enlarged flower-stalk, along with its huge flower-head, give it a most singular appearance.

As regards culture, the plant requires very liberal treatment. A light, sandy loam soil, having good depth, resting upon a porous subsoil, is most suited to its wants. Nor can the bed be prepared too deeply and well below, as it is a deep-rooting and feeding plant, which never gives a tithe of the bulk of crop it is capable of unless a deep tilth is insured. That it protrudes its roots through such good, properly prepared soil, to a depth of six feet, we have had ample means of testing.

Choose an exposed site as far as possible removed from tree-shade, &c. In instances where the soil is naturally light, to very light and stony, trench the chosen ground over as soon in the autumn or early winter months as possible. The trench may with advantage be from three to five feet deep, according to depth of subsoil. Place at the bottom a layer of crude straw and other open manure, not at all decayed, if procurable; turn over the surface spit from the next trench on to this, scatter another layer of manure thereon, and upon it another layer of soil, until the required depth of succeeding trench is arrived at. For the last layer of manure, immediately under the surface of the soil, use such as is more decomposed. Let the bed thus trenched over remain until spring, that it may have time to settle down and assume a nice firmness. Heavy soils need trenching in a similar manner. The heavier subsoil beneath such should in no instance be brought to the surface. So soon as it is reached, and cleared of the last layer of surface soil, deeply dig into it, turning it up as thoroughly as possible, so as to expose it to the immediate influence of the air. This done, throw down a layer of moderately decomposed manure, and fork it into the bed newly turned up; proceeding ultimately with the trenching in the usual way, adding layers of manure as liberally as possible. The more stiff the soil is, so much later ought this process of trenching in connection with such to be, as stiff soils cannot be made too free and open shortly before the time of seed-sowing.

Where trenching has to be dispensed with in connection with the crop, though it is not advised, very deep digging is essential. This can only be done with a moderately new long-bladed spade, keeping in process quite an open trench, and projecting the spade straight down to its utmost limit. Before the process of digging is undertaken, an abundant crop of manure must be wheeled on to the ground. Such manure should in this case be placed in each trench between the digging, and not dug in (in process of doing so), at one and the same time, else the digging will prove shallower by an inch or two, and the manure will not be placed so evenly at the bottom. When light soils, set apart for the crop, can only be dug, it is most important that it be done at least two or three months before the seeds are sown. Indifference to this, especially should a dry spring follow, will cause the crop to be a very poor one, besides admitting of a possibility that many seeds will not germinate well, if at all.

For the summer crop sow the seeds between March 25th and the middle of April. During a mild spring the former date or near to it is preferable. The old plan of forming narrow beds with alleys between is all but finally discarded. Choose a fine day when the surface of the soil is moderately dry. Hoe over the surface of the space intended to be sown, chopping down all lumps, &c., then roughly run a wooden rake to and fro over its surface, pulling off large stones, litter, &c. Then commence at one

end and tread the bed evenly all over, pressing and scuffling the soil in rows from end to end thoroughly. Again rake all over, making the whole as even as possible, and drawing off in process all additional stones, &c. Then stretch a garden-line from end to end of the bed at one side, and draw drill-rows as shallow as possible with the corner of a small hoe along it. If it can be arranged to have these drills running north to south so much the better, as the sun will have freer play around the plants. Continue to draw these drills at distances of four to five or nine inches apart until the whole piece is covered with them. The next process is to carefully sow the seeds in these drills. As many as three or four drills may be sown each time the bed is traversed. When sown, commence again at one end of the first drill, place a foot on either side of it, and with the feet proceed to cover the seed in the drill with the soil lying on either side. When all is scuffled in, again rake the whole bed over *across the drills*, drawing yet again all stones, &c., across with the rake, and the bed is completed, and ready for germinating into plant and its future growth. In the case of light soils it is certainly a further aid, following the last raking, to run a roller over all, as these plants delight to grow in firm soil, however necessary it may be to have it well prepared for them.

During the month of May, or subsequently, the young seedling plants will have assumed a size and consistency when further aid to progress may be given. Choose a small hoe, such as can be freely used between the rows, and hoe carefully between the young plants. In some districts a short-handled hoe is used rapidly and with some advantage; as by stooping and using the length of the arm *en procès*, a majority of the excess of the young seedlings may be cut out at this, the first hoeing, and before they attain a sufficient size to injure such as are ultimately to stand for growing and final ripening. This hoe is drawn along the rows straight, and the corner is here and there made to cut transversely across any row when excess of young seedlings need cutting out. From three to four rows are hoed each time the workman goes across the bed.

Early in the following month of June, a second hoeing will generally be requisite. At this hoeing, thinning out and the final "setting out" of such plants as are selected to remain will have to be finished. According to the preparation of the ground, its depth and manure supply, so must the process be conducted. When good preparation has been made, bulbs averaging from ten to twelve inches in circumference may be expected, and the young plants should accordingly be thinned out to distances of about six or nine inches apart in the rows. The only attention beyond which such a bed requires is to be kept free from weeds during the whole remaining part of the season. This is readily insured by occasionally hoeing the bed over. During dry seasons artificial waterings are of great benefit to them. It is by means of such that the fine Onions imported from Spain, as sold in Italian warehouses in this country, are obtained. During the autumn the crop will show signs of cessation of leaf-growth, when bulbing will commence. Should the stalks be at all strong, and whilst some stalks fall, yet others persistently stand, the bed should be gone over, when each erect one with half a twist of the hand may be made to lie, without in anywise injuring it. By this means the crop will ripen off more uniformly, individual examples throughout being better formed and ultimately better ripened.

It is bad practice to let the crop be too long upon the bed after initial maturity has been reached. The more uniformly all the tubers can be induced to ripen off together the better therefore. The surest sign of maturity is to be seen in the fact that the stem or collar immediately above the bulb, in the place where it is bent over, has become small. When it has assumed this small-waisted state, it matters not how green the fistular and now recumbent leaves are, then is the time to pull them up. Each one has to be taken hand-hold of, drawn, and laid upon its side; the whole being so laid that they make rows bottom upwards, close together, about three feet across. Here they will lie for a few days, when, with a wooden rake, draw them over (each row) into the vacant spaces previously existing between their former beds. Should the ground be at all weedy, hoe it over and rake off the weeds before drawing the bulbs over thereon. Generally about four or five such turnings will be requisite to insure that the crop be properly ripened. During rainy seasons, the process being more difficult, this time may be subject to extension. Every effort must be made, however, to hurry the process, else the crop will become discoloured, and certain of the least ripened bulbs will be subject to decay, especially so should maggot pests attack them—pests to which the Onion is subject, and to which reference will presently be made.

During a dry day, when the crop is properly ripened, the green leaves having decayed, the whole must be harvested. Each bulb should be taken in the hand and have the dried leaves and loose scales removed, all being subsequently placed upon a dry airy shelf in a cool shed. It is not important that they be spread out very thinly. When properly dried, they are found to keep very well in heaps under such a system of protection as this. According to the manner in which they have been perfectly ripened, or otherwise, so will the future need be of turning

the heap, removing all which show symptoms of decay, growing out at the apices, &c. Few vegetable substances are more disagreeable than the Onion in a state of putrefaction. Where crops are limited in extent, many growers prefer to rope or bunch them during spare intervals in winter, which is a commendable plan, as it aids in prolonging their keeping qualities when so treated and subsequently hung up in cool mid-air.

It will be convenient in this place to refer to the culture of Onions for pickling. Choose a piece of ground as exposed as possible, of a stony, poor nature; dig it up, make firm, and sow the seeds thereon, either in drill-rows or broadcast. Drill-rows are preferable, as the process of weeding is greatly simplified. The seeds must be sown thickly, and the whole seedling produce be permitted to grow very thickly together; poor ground and density of crop resulting in a mass of minute bulbs such as are required for the purpose here named.

A yet simpler mode of obtaining pickling Onions, admirably adapted for amateurs or other growers of small quantities, consists in laying in, as it is called, the thinnings of the main crops in crowded rows of from six to a dozen or more abreast. This is done by the taking out of a small opening as for digging, turning over a spadeful or so of earth, breaking the dug surface fine, sloping it down regularly with the spade towards the open trench, beating it firm and smooth, and laying in the Onions thickly, with the roots in the trench and the tops projecting a few inches above the newly-dug ground. Then place a little earth over the roots to hold them in position, invert a second spadeful of earth in front of the row of Onions, break it in fine, smooth down and level as before, insert a second row, and so on till the whole of the thinnings intended for pickling are laid in. All the attention that these inlaid Onions need during the season is simply keeping clean, and should dry weather ensue soon after inlaying, an occasional watering. But they must by no means be unduly stimulated, as otherwise they would outgrow pickling size. The idea is to starve and crowd them into sufficient smallness for pickling, and this the overcrowding accomplishes. The competition for food is so great, the struggle for life and room so severe, that it is physically impossible for the Onions to reach beyond pickling sizes. On the best and richest soils favourable to the growth of Onions, this mode of inlaying the thinnings in crowded masses is almost the only means of growing pickling Onions, and it is astonishing what quantities of good picklers these crowded rows yield at the end of the growing season. The process of harvesting is simply a repetition of that explained for the main crop.

Autumn-sown or spring and summer Onions require a separate and distinct treatment to the above crops. Small beds are well prepared in a somewhat sunny, sheltered part of the garden, wherein seeds are sown somewhat thickly, broadcast, between August 4th and August 12th. The young seedling plants resulting, kept free from weeds, remain in the bed until required for transplanting. During the month of December or January following, prepare a piece of ground, upon an open exposed site, as liberally and well as possible. Choose a fine period during the month of February following, rake over this piece of ground so prepared, draw very shallow marks or drill-rows across it from five to six or nine inches asunder. Carefully take up the young Onions in the seed-bed, and transplant them along these drill-rows at from four to five inches apart in the rows, according to how deeply and well the ground has been prepared. When transplanting them, take care to only place the roots firmly into the holes, as to unduly bury the stalks will act antagonistically as regards their ultimate full and fine bulbing powers. See that worms do not draw them out by the roots, keeping the ground hoed and free from weeds when spring arrives. Should any show signs of pushing up flower-stems, remove such stems immediately; bend the necks of stiff ones down when the general crop shows signs of ripening; draw and harvest about midsummer, as advised for former crops.

For the first division, or spring-sown crop, good selections of White Spanish, such as Nuneham Park, are desirable. For later-keeping ones a portion may consist of Main Crop, James Keeping, and Bedfordshire Champion. For picklers, White Spanish, or White Nocera, The Queen, and Silver-skinned; and for autumn-sowing, Tripoli, or the improved varieties, Neapolitan Marzajole, Giant Rocca, and White Lisbon.

The Potato Onion, a hardy variety, propagated generally by division, treat similarly to Shallots, upon deep, rich ground; plant at distances of six or eight inches apart. Onions are liable to attacks of the Onion-fly, *Anthomyia ceparum* and *Eumerus Æneus*. To deter their attacks scatter soot lightly over the plants monthly, whilst growing.

Parsnips (*Pastinaca sativa*). French, *Panais;* German, *Pastinake;* Spanish, *Pastinaca.*—The Parsnip, or "Parsnep," as it used to be written, is a British plant and a biennial, which succeeds best in a deep rich loam of moderate consistency. According to old authorities, a light soil suits it best. It will succeed in such during rainy summers. To insure heavy crops, however, it is essential to grow it upon ground having sufficient consistency to hold and maintain a liberal supply of latent moisture con-

stantly; if the root lacks this during the months of August and September, finely-developed produce, containing a minimum quantity of heart or centre, is not to be expected. Being a native plant it is hardy, and the fact that it is invariably found in its wild state upon calcareous soil affirms what is said above.

The ground should be trenched, if possible, to a depth of at least sixteen inches, a liberal layer of manure placed at the bottom and midway therein; but it is not advisable to enrich the soil unduly near to the surface, as this incites root-division, which causes individual plants to become forked, to the great demerit of the crop. The ground should be prepared as early in the month of February as is convenient.

Sow the seeds during the first week in the month of March, or as near thereto as weather permits. It is always desirable to sow such seeds when the surface soil is dry and workable. The better plan is to draw drill-rows, which should not be less than twelve to fifteen inches apart. Undue crowding of the young plants, an all but invariable error, makes it impossible for individual plants to grow to such a size as they are under liberal culture capable of doing. Towards the middle of the month of May the young seedling plants will have attained to such size as to require thinning out. The proper distance apart in the rows is eight inches. Should vacancies exist they may be made up by transplanting strong plants, with a deep dibble, wherever they occur. The only after-culture requisite consists of periodical hoeings, to maintain the soil loose between the plants and destroy all weeds so soon as they appear.

There is not much variety here. The Student is a new variety prized by many. The older original Hollow Crown variety is not probably yet surpassed for general qualities. A strong variety has long had prominence in Guernsey and Jersey, which is sometimes called Cattle Parsnip—the *Coquaine* of the French, who also grow the *Lisbonaise*, a variety called sometimes the Malta. The Student is considered by some better than either. The seeds require to be dropped somewhat thinly, into inch-deep drill-rows recommended, and should then be covered over in the usual way.

Pea (*Pisum sativum*). French, *Pois;* German, *Erbse;* Spanish, *Giusanti;* Italian, *Pisello.*—The Pea is a hardy annual, native of Southern Europe; its introduction is of long standing, though it is noteworthy that in the time of Queen Elizabeth (*vide* Fuller) the produce was introduced periodically from Holland for use at the royal table. Like many plants which are natives of Southern Europe, it will in a young state withstand the adverse influences of British winters.

Few amongst popular vegetables have been improved so greatly of late years. In contrast to the original old "Charlton" of English gardens, and the *Nanterre* of French gardens, possessing pods only about three or four inches long, with a similar number of small peas within, varieties now exist having pods of about double the length, containing from nine to twelve large peas in each.

The treatment of the several successional crops has to be varied somewhat in accordance with the season when the seeds are sown, and that in which it is intended the crops should come to perfection. For instance, when sown in the autumn for standing, in short seedling plants, through the fluctuations of our long winter months, for the very earliest crop, or sown very early after the advent of the new year with a like intent, a light, porous, sandy soil is the one suitable, and it should be one also exposed to all the sun possible, sheltered from northerly and easterly winds by walls, fences, or belts of trees, standing sufficiently far back not to in any way influence the young plants, either by shade of upper growth or adverse encroachment of root on to the cultivated area whereon they are grown.

For the permanent crop a deep rich loam of a tenacious nature inclining to be clay-like is essential, or the crops, grown as they are thickly together in rows, will assuredly suffer during dry or moderately damp seasons. The result will be a too limited growth according to kind, an equally limited crop, and the undue hurrying of even such crop into the dry seed-bearing or ripening state, in opposition to a continued successional supply of large succulent pods, containing peas within in kind also.

These remarks amply show that such a crop as this, if worth growing at all, should be grown well. It is far better to sow only a row of each of the early kinds, second early, and general crop, upon well-prepared ground, than to sow quantities in duplicate upon poor or indifferently-prepared soils. It is advised, therefore, that such good stiff loam as recommended be chosen as far as possible upon a fully-exposed sunny site, and one not too near to fruit-trees, which so generally exist in vegetable gardens; for which purpose deep trenching, such as is advised for the Onion crop, is equally important. Roots of Peas penetrate somewhat deeply, and unless they find nucleus for advance of growth at a depth below that to which simple digging can deposit manure, the growth will succumb at the most important time of all. All ground trenched—and in lieu of trenching proper, bastard trenching is strongly advised—should be so treated during the winter season; and the lighter the soil to be operated upon, so much the earlier should this be done. Too much manure—and it may be of a coarse, crude, or

green nature—cannot, in reason, be placed at the bottom and midway in these trenches. The results repay all such outlay. A conspicuous feature in connection with the Pea crop is to be observed in the exceptional manner in which the roots absorb all available moisture. Whatever the summer season may be, whenever old Pea-haulm which has carried a crop is removed, the ground wherein the roots have expended their powers of growth is found to be as dry as it is possible for it to be. To neutralise this by enrichments, by waterings and surface mulchings of moist manurial matter, is therefore a need which is far too general in the neglect rather than the observance of. The intelligent cultivator will do well to take note of these simple facts, correct the errors, and reap the profitable results.

In the matter of seed-sowing for this crop, practice varies greatly as connected with thin and thick seed-sowing. The rule is to sow, at least, cent. per cent. too thickly. In the Principality the practice sometimes exceeds this, on the side of error, the quantity of seeds sown in single rows being in some instances surprisingly great. Upon the principle that unless each plant develops its vigour in moderation properly good results cannot follow, good produce is thereby made an impossibility.

For the earliest spring pickings—which should take place in the month of May, and the earlier the better—certain early sorts, being of rapid growth, must be chosen, and happily an improvement is rapidly taking place in regard to such. Independently of the old early "White" Peas, those called commonly "Blue" Peas, which are an approach towards the highly-valued Marrowfats, have been added to early varieties, and being both hardy, of moderate height, and rapid development, come in nearly if not quite as early as the former.

The earliest crop is somewhat of a speculative one. Whilst it is not possible to foresee what kind of weather the winter has in store, and how it will fare with late autumn-sown, such a sowing is, however, imperative in connection with growers who aim at gathering as early a crop as possible. For these sowings the most sheltered and best situation is one at the foot of a south-aspect fence. The time for sowing is during the early part of November, and again towards the middle of December. The drill-rows drawn for these sowings should be one inch and a half deep, and three feet distance one drill from the other. These drill-rows should be drawn wide or with the whole flat blade of a four-inch hoe, so that the seed Peas are somewhat divided therein when sown, in such manner as they could not be were the drills drawn with only one corner of the hoe-blade. For these speculative crops, and in consideration that the young plants have to withstand the whole severity of the winter, with insect-attacks, &c., the sowings should be made somewhat more thickly than is advised generally. When sown, draw the soil over on to them, chopping down all lumps, and make the soil fine and even immediately over the seeds.

Such winter or early crops will require especial attention. So soon as the young seedling plants are two to three inches above the ground, commence drawing the loose soil from both sides towards the young plants. Choose a fine day when the surface of the soil is dry, and at the first earthing hoe along close to the two sides of each row, chopping the soil down fine, then draw it close up to the base of the young plants, to a depth of about two inches. In a fortnight's time they will require yet another moulding. This time draw a larger quantity of soil towards both sides, but do not bring it into immediate contact with the young plants. Rather endeavour to form with it a ridge on either side of each row higher than the apices of the ridges last made in moulding up. Repeat the moulding as the winter advances, making such ridges still higher if possible, the object being to form ridges for protection against cold generally, keen wind-frosts more especially, for if these be permitted to have full play upon the tender plants, they dash them against the hard frosty ground, twist them about, and cause irremediable injury.

During very severe winters it is needful to scatter a little lime over the surface of the soil, and lay on either side of each row a ridge protection of coarse stable litter or, where obtainable, Bracken Fern. Sticking is an important protective winter aid to these early crops, and must be done so soon as the crop is high enough for the purpose. So soon as the young plants rise to a height of about four inches, place sticks to them in the manner referred to below. Well or deeply hoe between the rows in the early spring, when active growth begins: and should it be desirable to hasten the crop, even by a day or two, pinch off the top of each growing plant so soon as flowers and their infant pods, in sufficient numbers for the crop, have been secured.

For the main crop, ground having been prepared as advised, the first sowing should be made during a mild period towards the end of February. For this and the following sowings, duplicate sorts must be sown upon one and the same date, by which means a successional supply will be insured after once a first gathering has been made. For the autumn sowings William I., Kentish Invicta, Day's Early Sunrise, and Dillistone's Early are most suitable.

A row or two of each of these should also be again sown during this February sowing, and along with them Earliest of All. Again in March, choosing fine

weather, make sowings of such as Stratagem, Wonderful, and Princess Royal. Three weeks later sow one or the other of these three last named, along with such varieties as Telephone, Veitch's Perfection, and Ne Plus Ultra. Continue successional sowings of these last or similar good varieties every three weeks until the end of the month of May has been reached. During the months of June and July sow these successions so soon as each last sowing is through the ground, or in round dates about once a fortnight.

The tall-growing kinds should be sown about one foot wider apart in the rows than the short ones before named. Draw the drills for these tall sorts also with a six-inch-blade hoe if possible, making a wide drill-row, over the whole space of which scatter the seeds. Chop the soil down from each side of the drill-rows, after having first pressed the seeds down into the soil with the foot to secure firmness and more ready germination at such times as the weather proves dry. Leave the surface somewhat rough and loose over the seeds, and do not raise too great a ridge over them, but let it lie flat to catch such rain-showers as fall uniformly all over.

When these main crops have attained to the height of two or three inches above ground, draw just a few inches of soil close up to the young plants, then hoe deeply beside the rows and across the whole extent of the alleys between them. Now draw quite a large ridge of soil up towards each row on both sides, but not nearer to it than two or three inches, making a table-land, from which the young plants grow, with a ridge around it. By so doing heavy rain-showers will flow direct on to and over the roots, and not, as is too often the case, be driven away from them into the alleys. Artificial waterings can also be given to them with far better effect. To aid rains to thus penetrate to the roots, the sticks should also have their base placed just inside the outer ridge of this table-land on both sides.

Pea-sticks should be prepared strong and thin. All ill-placed branches should be cut off, and the spray branchlets from their apex; so that each stick should form extended horizontal arms whereby to conduct the plants in their upward growth, and to maintain them permanently in future against the incidence of heavy rain and wind storms alike. During a dry season such sticks may be somewhat less in height than the reputed height of given sorts. During rainy seasons they should be higher.

Take care to point each stick well without jagged edges, so that in pressing them into the ground risk of injury to the roots below is reduced to a minimum. The sticks must be placed in the ground so that they are as wide apart row from row, top and bottom or each end, as is the base of the two rows apart. Amateurs generally make them meet at top, which is a very objectionable practice. It aids the young plants to clasp the sticks with their leaf-tendrils as they travel upwards, to place the sticks slanting in the rows. Commencing with the first stick at one end so slanting, each one in succession should be placed at the same divergence from upright. When the two main rows of sticks have been fixed on each side any single row of Peas, a few of the short branchlets cut off in process of trimming might be inserted all around, in the openings existing between the larger sticks, as an additional aid and incentive to activity of the young plants.

Birds of minor kinds are often very destructive to the Pea just at the time when germination takes place, and the young plants issue through the ground. At such a stage the common house-sparrows often clip off the young heads out of, as it would seem, sheer wantonness. Pea-guards are useful deterrents, so also are one or two threads stretched along the rows at about two inches above the young plants. Such threads cannot be too small or too transparent, however. These wary birds are more opposed to contact with such a minor matter they cannot understand, than of strong string, which they would not hesitate to settle upon.

Finally, for very late crops in autumn, the early kinds sown during November, &c., have been very generally recommended. For late autumn picking, however, no sort is better than the old Ne Plus Ultra, of which additional sowings might be made late in July.

Artificial waterings are an important aid to Peas during dry or moderately moist summers. Whenever resorted to, however, they should be copiously applied, along with waterings of liquid manure, as occasion may demand. Mildew often attacks late Peas with great virulence. It is easily destroyed by dusting the whole surface growth over with flowers of sulphur.

Both the hawfinch and blue tit are often very destructive to peas. The former must be shot, and the latter kept off by similar means or by netting, &c., else will all pods be destroyed.

Dwarf varieties of Peas are very easily forced or forwarded in pots. Similar treatment to that required for Dwarf Kidney Beans, but with an average of about 5° less heat, suits them admirably. Varieties suitable for this purpose are Little Gem and American Wonder.

Desirable varieties are—First early: Dickson's First, Dr. Hogg, Day's Early Sunrise, William the First, Kentish Invicta, and Paragon. Second early and general crop: Dr. Maclean, Evolution, Champion of England, Gladiator, Telephone, Veitch's Perfection, Dignity, Charles the First, Hunting-

donian, Maclean's Wonderful, Telegraph, Stratagem, John Bull Magnificent, Harrison's Glory, G. F. Wilson, Dickson's Favourite, Victory, Duke of Connaught, Robert Fenn, &c. For later crop: Emperor of the Marrows, Maclean's Best of All, Ne Plus Ultra, Sturdy, British Queen, Culverwell's Giant Marrow, Omega, Prince of Wales, and Yorkshire Gem.

Rhubarb (*Rheum Rhaponticum.*) French, *Rhubarbe;* German, *Rhabarber;* Italian, *Rhubarbaro;* Spanish, *Rüibarbo.* The common culinary Rhubarb deserves notice here, even though its leaf-produce is subject to somewhat different treatment to what other vegetable comestibles of the garden are. As a perennial plant, introduced originally from Asia, it is as hardy as it is easily grown, and popular amongst all classes. Many garden varieties, some of which are great improvements on the original species above, exist. All may be increased, either by seeds or division of the roots, as every crown attached to old stools will separate, and form independent plants readily when separately planted.

In forming new plantations it is most economical to trench the ground two or three feet deep, or to the depth at which the subsoil is found. The more manure, in reason, then placed at the bottom of the trench, and midway up it, so much the better, because it is not possible to make any additi ns thereto during the existence of such plantations. The plants, which may be possessed of two or three crowns each, should be planted upon such newly-prepared ground in rows three feet apart, and two feet distances apart in the rows. Care must be taken upon trenched ground to somewhat elevate the crowns at the time of planting, else when the ground finally settles down, they will be found to be too deep, which is a drawback to continued success in the future. Not only does this plant succeed better elevated somewhat above the mean level of the surface; but by being so placed a better opportunity will, besides, be given, to add manure abundantly, in the form of mulchings, to the surfaces of the roots. Having planted such a plantation, it will, aided by these latter mulchings, last in full productiveness for years, the only further labour requisite in regard to it being an annual early spring forking over of the surface-soil, and the needful amount of hoeing to keep it free from weeds.

Seeds may be sown either in deep boxes filled with rich soil, under glass protection, upon a slight hotbed, or upon a warm, sunny border out of doors. In the two former cases the month of March should be chosen, and the latter about the middle or end of the month of April. So soon as the plants become large enough, transplant from the two former on to a rich nursery bed. Thin out the plants upon the latter when large enough, transplanting such young seedlings as are drawn in the operation. Grow the young plants in these nursery beds until large enough, then finally transplant into permanent plantations, as before advised. The variety named "Paragon" is one of the most prolific amongst late improvements. The crowns are, however, so easily divided, that unless for new varieties, root division is the simplest means of propagation.

Hastening forward or forcing Rhubarb is exceedingly easy and simple. Any time after the middle of the month of December proper forcing or sea-kale pots are placed over each crown (large-sized flower-pots may be inverted over them), these are subsequently covered over with fresh manure in a state of ferment. By ensuring that the heat rises to 80° or 85° Fahrenheit during the first week, gradually falling down to 58° or 60°, growth will be caused within, and a good crop of tender semi-blanched leaves will result. By similar treatment during the months of February and March, using any kind of straw, litter, or kindred covering in lieu of fermenting materials, the natural supply will also be hastened a month or two. Roots may also be taken up and potted, or placed into mould in a mushroom shed or other warm place, which being well watered will also give from two to three crops of leaves suitable, in rapid succession. Established plantations are prone to run to seed somewhat about Midsummer. It is very important that such stalks be removed immediately they make their appearance, else they rob the base of much strength, which should repose in the roots below for future expenditure in needful root form. It is an error to deprive plantations of their leaves more than about three or four times in succession during any spring season, A good display of such should be permitted during the summer months, to remain upon the plants for autumn ripening down, whereby alone means of a good and abundant crop in the spring following is assured.

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